LITHIC ANALYSIS AT THE MEAD SITE, CENTRAL ALASKA

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Abstract

The purpose of this study is to understand chipped stone technological behaviors at the Mead Site located in central Alaska. Lithics from each cultural occupation ranging in age from 11,460BP to 1420BP were analyzed and compared. Specific objectives include (1) characterization of variability in raw material and use for each cultural component, (2) description of lithic stages of reduction represented in each component, (3) description of the basic lithic industries represented, and (4) the identification and characterization of spatial organization and lithic behaviors. Results indicate (1) the tools and debris from Cultural Zone (CZ) 1b and CZ2 show preferential use of local materials, while the tools from CZ3b and CZ4 are largely manufactured using nonlocal materials, and the debitage assemblage is dominated by locally available material, (2) CZ1b was a long term occupation, while CZ2, CZ3b, and CZ4 were short term camps, and (3) CZ4 is characterized by intensive primary reduction of a local quartz, while CZ2 is characterized by biface production. These patterns suggest similar technological strategies were employed at Mead in the Late Pleistocene and Early Holocene with an increase in tool form diversity and greater reliance on higher quality locally available materials during the Mid Holocene.

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Chapter 1 Introduction

In order to contribute to the growing knowledge about Late Pleistocene/Early Holocene archaeological sites in Alaska, this thesis provides an analysis of lithic technological behavior and spatial patterning at the Mead site using debitage collected from recent excavations. The Mead site is a deeply buried, multi-component site with good stratigraphic control. Two other sites located in close proximity are also known to have deep cultural contexts: Swan Point and Broken Mammoth (Figure 1.1). Both sites have yielded significant information about late Pleistocene/Early Holocene peoples (Hamilton and Goebel 1999; Holmes 2011; Yesner 2001; Yesner and Pearson 2002). However, debitage analysis was not conducted at Swan Point and Broken Mammoth, so we therefore lack an understanding of basic lithic behaviors for these early periods. Together with the Mead site these site comprise the earliest accepted dates for cultural occupations in Eastern Beringia (Holmes 2001). Although its significance has long been recognized, limited work has been done at the Mead site up until 2009. This thesis will provide a substantive analysis of the lithics at the Mead site focusing on understanding behavior through the debitage assemblage.

Alaskan archaeology has historically focused on placing sites and occupations within cultural categories (e.g. Denali or Nenana) based on presence or absence and style of different tool forms (Ackerman 2004; Cook 1968, 1969, 1975; Dixon 1985; Dumond 1969; Goebel and Bigelow 1992; Holmes 1998; Morlan 1997; Pearson and Powers 1999; Powers 1983; Powers et al. 1990; Powers and Hoffecker 1989; West 1967, 1975). Because of this, a skewed focus towards the tool forms found in a lithic assemblage has persisted. It has been demonstrated that debitage assemblages provide more insights into lithic behaviors (Ahler 1989; Andrefsky 2001, 2005, 2009; Beck 2008; Bradbury et al. 2008; Carr 1999; Carr and Bradbury 2001; Goodale et al. 2008; Milne 2009; Pecora 2001; Prentiss 1998, 2001; Shott 1994; Sullivan and Rozen 1985). This thesis aims to utilize new approaches in debitage analysis in order to better understand behavioral patterns at the Mead site.

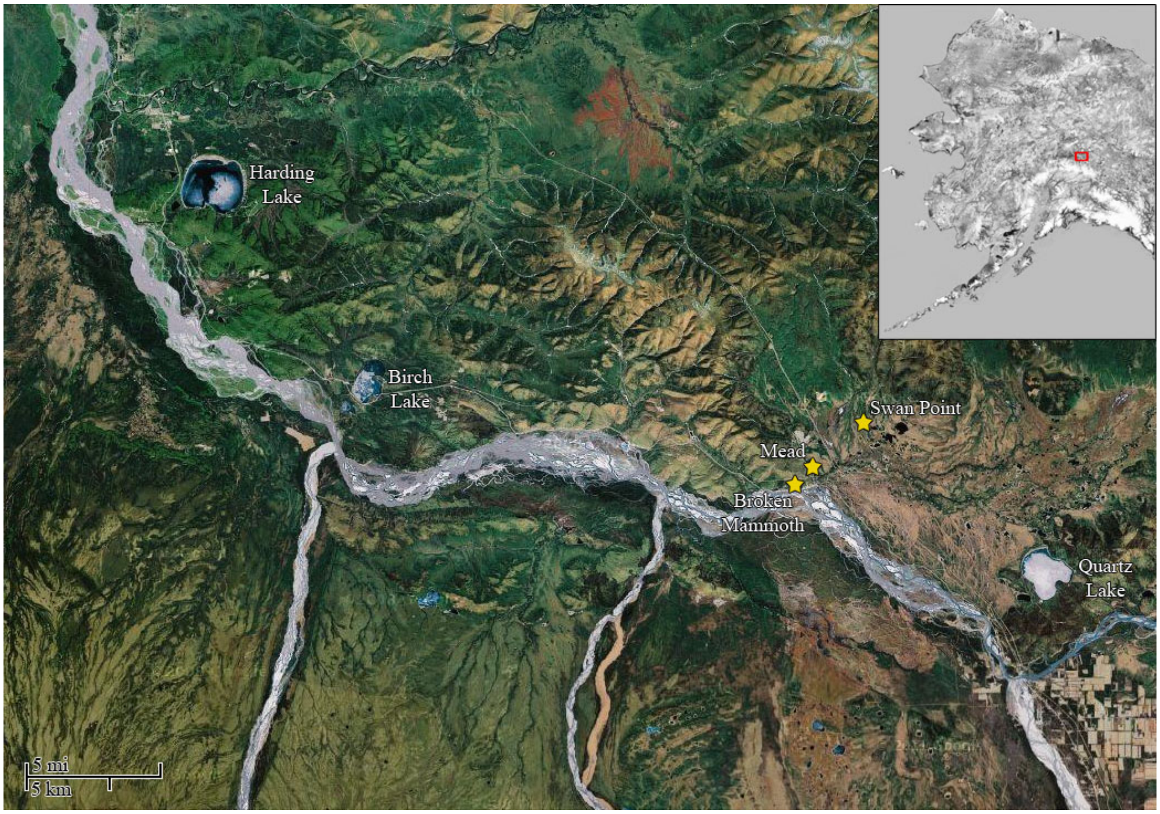

Figure 1.1 Location of the Mead site

Research involving lithic analysis at comparable sites, such as Swan Point and Broken Mammoth, have tended to focus on tool forms as a way of cultural designation, or subjective descriptions of debris flake types as a method of understanding technological behavior (Holmes 1996, 2011; Holmes et al. 1996; Yesner et al. 1992). This thesis is geared to understand the debitage assemblage and the technological organization of each cultural component using more objective methods of analysis. Individual flake analysis (IFA) provides descriptions and measurements of flake variables demonstrated to correlate to different reduction strategies. The Modified Sullivan and Rozen Typology (MSRT) is used to characterize lithic reduction at Mead using objective classifications based on the completeness of a flake that also correlate to reduction strategies. Using MSRT and IFA in combination, behavioral information such as raw material procurement strategies, curation and toolstone conservation, as well as stages and types of reduction are inferred.

Spatial organization of the site allows components to also be evaluated. Spatial patterns among lithic artifacts can help infer activity areas and behavior at a site (Binford 1983).

Prehistoric archaeological sites are comprised almost entirely of debitage and, taphonomic factors aside, debitage flakes tend to remain in their original depositional context (Odell 2003:120). The secure spatial context of the cultural components at Mead, particularly in the lower occupations, and abundance of debitage allows for more in-depth insight into activities and technological organization of the site. Because the sample size is large, about 7,394 chipped stone artifacts, I can evaluate variability within and among components.

1.1 Research Objectives

The overall goal of this thesis is to provide an understanding of the lithic assemblage and lithic behaviors at Mead. This includes general description of the lithic industries represented, characterization of raw material variability and use for each occupation, as well as understanding broader behavioral inferences concerning technological organization and spatial patterning of the lithics at Mead. This research highlights the need for more debitage studies that are directly linked with experiments to produce rigorous inferences about the behaviors and activities of past peoples through chipped stone technology.

1.2 Research Questions

Lithic analyses have been directed towards various ends, including techno-typological approaches geared to assigning cultural affiliation (Cook 1996; Holmes 2001; Powers et al. 1990; West 1975), geochemical sourcing studies aimed at evaluating exchange and mobility (Cook 1995; Reuther et al. 2011), and technological organization studies designed to evaluate organizational properties of hunter-gatherers (Bamforth 1986; Binford 1979; Bousman 1993; Flenniken and Raymond 1986; Larson 1990; Potter 2005, 2008a; Shott 1986). Some of these approaches use experimental support to aid in developing robust inferences (Amick et al. 1988; Dibble and Whittaker 1981; Keeley and Newcomer 1977; Odell 1989; Schiffer and Skibo 1987; Shott 2013). The approach taken here is fundamentally concerned with building strong inferential arguments about lithic behaviors that can be directly compared with an extensive experimental literature, independent of the archaeological record. Specific research questions addressed in this thesis include assemblage demarcation (question 1), intra-component variability (questions 2-4), and inter-component variability (questions 2-6).

1) Do components represent palimpsests or individual occupation events? A single cultural component at Mead defined by stratigraphic separation could represent a palimpsest of cultural material from many occupations rather than one occupation. Such palimpsests could

mask variability in an assemblage and should be identified before proceeding with lithic analysis. In order to determine this, spatial delineation of each component along with radiocarbon dating of features found in each cultural zone is evaluated.

2) How is lithic technology organized at Mead? The organization of lithic technology, including raw material procurement, manufacture, use, maintenance, and discard can inform on behavioral patterns and decision-making processes associated with tool use-life (Kelly 1988; Koldehoff 1987). Further questions aimed at understand technological organization include: Can procurement patterns of toolstone be identified? Which lithic reduction stages can be recognized in each cultural component? Do multiple reduction strategies occur within single components? Are raw materials being utilized differently between each component?
3) Is there variation among depositional sets that reflect lithic-related activity areas? At Mead, spatially patterned archaeological remains are patterned due to human behavior rather than taphonomic processes, especially in CZ3b and CZ4. This distribution of lithics in an occupation should reflect underlying behaviors, including social organization, occupation length, and occupation type (Clarke 1977; Schiffer 1972). For example, highly variable lithic clusters and discrete activity areas can be indicative of extended occupation while redundant clusters represent short term occupations. Additionally, types of activities identified through lithic analysis by specific cluster can provide insight into the function of the site and the mobile strategy of the occupants.
4) What conclusions can be drawn about site function and forager adaptive strategies from the lithic patterning? Lithics can inform on broader behavioral patterns such as mobility within a region, the function of the site, and occupation span. Patterns that inform on raw material procurement methods as well as curation of toolstone and variability within spatial clusters can illuminate different mobility strategies. Within a specified mobility strategy, site types, such as residential base or extractive locations have expected patterns. Occupation span of a cultural component can also be estimated through the lithics in formal tool type frequencies and ratios of use of local and nonlocal material. Each behavioral pattern implicates a broader behavioral strategy being used at the site, and changes through time (see question 5).
5) Are there identifiable differences in technological and spatial organization between each cultural component represented at Mead? The five cultural components at the site span a broad range of time and changes in technological and spatial organization seen at Mead may inform on changes in broader behavioral patterns in central Alaska.

6) How does the assemblage and behavioral inferences at the site compare to existing interpretations of technological variability in central Alaska? In order to place the Mead site in context with central Alaskan archaeology, the findings presented in this thesis will be compared to other research in the region. Comparable lithic analyses include the work done on the Gerstle River, and Dry Creek sites. General comparisons can be made with neighboring sites Swan Point and Broken Mammoth. Additionally, broader behavioral patterns are compared using expected patterns from the Paleoindian and Northern Archaic traditions.

Chapter 2 Methods and Procedures

2.1 Research Design

As early as 1972, Crabtree proposed the study of lithic waste flakes as a way to determine stone tool production activities at a site. Archaeologists began exploring methods and implications for debitage analysis (Amick and Mauldin 1989; Amick et al. 1988; Ammerman and Andrefsky 1982; Andrefsky 1986; Ingbar et al. 1989; Sullivan and Rozen 1985). Since then, lithic debitage analysis has been commonly used and is becoming increasingly more valuable in archaeological research. Many archaeologists have experimented with debitage analysis and tried to define what variables should be included in a study (Amick and Mauldin 1989; Andrefsky 2005; Bradbury and Carr 2009; Carr 1999; Carr and Bradbury 2001; Odell 2003; Prentiss 1998, 2001; Shott 1994; Sullivan and Rozen 1985; Tomka 2001), but methods remain varied and heavily debated, resulting in the absence of a standard approach towards debitage analysis. This is both a hindrance and an opportunity. Different lithic systems have different constraints, and the lack of a standardized approach towards debitage analysis allows a researcher to tailor their variables to the limitations of their project and their specific research questions.

For this thesis, individual flake analysis (IFA) is one primary methods used to record the characteristics of the debitage assemblage. IFA is in contrast with Mass Analysis as the two primary methods of debitage analysis in archaeology. While Mass Analysis derives its inferences from flake size and weight, IFA involves the recording of several attributes for each flake in an assemblage. Because of the size of the assemblage at Mead and the specific goals of analysis, IFA was chosen over Mass analysis. Attributes were chosen based on their reliability to yield relevant information, comparability with other research, and efficiency in terms of time taken to measure and information gained. A comprehensive list and description of flake attributes are provided in Appendix B. Once attributes were measured and recorded, the Modified Sullivan and Rozen Typology as well as Attribute Analysis were employed to understand the technological organization strategies of the past population represented at Mead.

2.1.1 Technological Organization

This thesis uses technological organization as the theoretical framework to evaluate lithic behaviors. The study of technological organization focuses on specific adaptive strategies employed in the past that are reflections of decisions regarding tool use-life, i.e. procurement, manufacture, use, maintenance, and discard (Kelly 1988:217; Koldehoff 1987:717). Technological organization was originally seen as a way to understand variation in lithic assemblages (Binford 1973, 1977a) and the relationship between technological strategies and economic and social influences of a group (Andrefsky 1994; Bamforth 1991; Bleed 1986; Johnson and Morrow 1987; Kelly 1988; Parry and Kelly 1987; Shott 1986; Torrence 1983). Technological organization involves many domains of inquiry such as raw material availability and quality, procurement strategies, mobility, and tool efficiency, reliability, maintainability, and effectiveness. These areas of technological organization have been widely used by archaeologists as a way to interpret lithic assemblages (Andrefsky 1994; Bamforth 1986, 1991; Bamforth and Bleed 1997; Beck 2008; Binford 1973, 1977a, 1979, 1980, 1982; Bousman 1993, 2005; Bradbury et al. 2008; Carr and Bradbury 2001; Kelly 1983; Kuhn 1990, 1992, 1994; Nash 1996; Nelson 1991; Odell 1988, 1996; Parry and Kelly 1987; Shott 1986, 1996; Shott et al. 1989; Torrence 1983). The decision to employ a specific strategy in any of these areas is influenced by variables such as mobility patterns, resource distribution, and associated risk and costs. Variables that can help evaluate these behaviors include: degree of maintenance and recycling, conservation, curation, assemblage composition, and reduction stages present.

The study of technological organizational strategies are used to better understand the relationship between the availability of tool stone, where tool activities take place, raw material use, and other processes (Bamforth 1986; Binford 1979; Keeley 1982; Parry and Kelly 1987). In order to do this, observations must be made through controlled studies in ethnography and ethnoarchaeology about the nature of the relationship between material patterns and behavioral patterns. Although the use of ethnographic analogy in archaeology is heavily debated (Binford 1967, 1985, 2001; Gould 1980, 1985; Gould and Watson 1982; Wylie 1982, 2002), it remains an important approach towards understanding behavior from archaeological remains.

In tool production, several factors may influence the creator's design. These factors are influence by the needs of the creator which vary depending on the behavioral patterns of the designer. Curated tools, tools that are maintained and transported multiple times, can focus on reliability, maintainability, or efficiency. A maintainable tool can be used for more than one task and are designed to be usable even after broken, either for their original intended use or recycled for a another use. They are often light and portable as a result of their longer use-life and the need to transport the tool. Because maintainable designs allow for flexible use of a tool, these tools are primarily used to cope with unpredictable and diverse resources (Bousman 1993:70).

Reliable weapons are specialized and sturdy (Bleed 1986) and are often used when the consequences of not obtaining a resource could be severe. These types of tools require a considerable amount of planning and forethought. Efficient tools are made to increase the number of usable tools from a single raw material unit. By employing this strategy, the cost of obtaining raw materials is reduced (Bousman 1993:71). By measuring the reliability, maintainability, etc. of a tool, implications about the subsistence and mobility strategies can be made.

A separate category of tool exists without the influencing factors of reliability, maintainability, and efficiency. Expedient tools can either be created as part of a planned toolkit, where raw materials are accessible and minimal tool use will be required for a short period of time, or as on opportunistic result. The difference is that opportunistic expedient tools are created due to an unanticipated needed and true expedient tools are made as part of a strategy and planned for (Bousman 1993; Nelson 1991). Bousman (1993) summarizes the technological needs of foragers and collectors following Binford's (1980) original designations. In general, foragers will have broad, generalized tools and weapons that focus on maintainability. Tools will tend to have longer use-lives and therefore will be subject to more maintenance and repairs. Collectors on the other hand, will have a more specialized toolkit with a focus on reliable tools. These tools usually have shorter use-lives with more production and replacement occurring rather than recycling. (Bousman 1993:78). By measuring tool attributes related to use-life, maintainability, expediency, etc., as well as observing overall flake distribution patterns within a site, inferences can be made about the needs and behaviors of the users.

For example, an expedient technological strategy is expected to take place when raw material availability is predictable and easily accessible (Bleed 1986; Parry and Kelly 1987). Likewise a patterns exhibiting curation and conservation of raw materials is expected when raw material resources are limited (Bamforth 1986; Brantingham 2003). Parry and Kelly (1987) argue that the planned stockpiling of material or anticipation of raw material in revisited sites is means enough for expedient technology. Parry and Kelly (1987) stress that a place needs have been regularly or repeatedly occupied to allow for the stockpiling of raw material. Torrence (1983) adds that there needs to be no time stress for expedient technology to be chosen i.e. there are materials available when needed. Cobb and Webb (1994) demonstrate that tools are less likely to be maintained the closer an individual or group is to a source of quality raw material. Nevertheless, the availability of raw material is an insufficient factor for selecting for an expedient strategy. Some archaeologists argue that residences occupied during low productivity seasons have more downtime and therefore should have more evidence of repairing and maintenance i.e. curation (Binford 1979; Gamble 1986; Keeley 1982; Torrence 1983) but only at residences where raw material is available (Binford 1979; Morrow 1987; Parry and Kelly 1987). However available raw material makes it possible for expedient strategies, further complicating the parameters for selection of one strategy over the other (Gallagher 1977; Johnson 1987; Keeley 1982; Kelly 1988; Parry and Kelly 1987).

These relationships concerning raw material and tool production and maintenance strategies also inform on mobility as seen through the works of Binford and O’Connell (1984), Kelly (1988), Kuhn (1994), Bamforth (1986) and Brantingham (2003). Kelly (1988) shows that a shift in the use of bifaces as cores to an infrequent use of bifaces as tools relates to a shift to logistical mobility and short-term use of sites. Kuhn (1994) argues that transport costs (e.g. weight) supersede the variables of durability and versatility of a tool. If this is true then an archaeologist should expect to see smaller, more curated tools in more highly mobile groups. Braun (2005) and Brantinghamn and Kuhn (2001) both demonstrate that toolmakers conserve materials when raw material resources are limited, and Andrefsky (2008b) and Kuhn (1991) demonstrate that raw material proximity does in fact influence degree of retouch. The interconnectivity between raw material resource distribution and mobility patterns throughout the landscape expressed in these examples, generate expected outcomes that can be applied to lithic assemblage such as the collection from Mead in order to make inferences about mobility patterns based on the presence, absence, or degree of variables associated with forager/collector strategies.

One of the important concepts surrounding raw material and technological organization is the strategy of procurement of raw material. The procurement strategy of material is also linked to mobility patterns and provides another avenue to explore how groups move across the landscape. Archaeologists generally divide procurement strategies between embedded procurement i.e. the acquiring of raw materials as part of larger subsistence and mobility patterns, or direct procurement i.e. organized trips specifically designed for the task of acquiring raw material. This is most heavily debated by Binford and Gould (Binford 1973, 1985; Binford and Stone 1985; Gould 1985; Gould and Saggers 1985). Ethnographic examples of direct and embedded procurement are very few but there are some excellent examples (Binford and O'Connell 1984; Gallagher 1977; Gould and Saggers 1985). While ethnographic examples do exist it is even more difficult to find an application of inferences made by ethnoarchaeology to an actual archaeological dataset. However Bamforth (1991) successfully applies findings concerning technological organization from ethnographic examples to an archaeological dataset. Seeman (1994) adds to the debate surrounding embedded or direct procurement strategies by stressing that raw material procurement is one of many aspects of technological organization and is influenced by the system it is contained within. He demonstrated that multiple strategies could have been employed during one occupation, and that past strategies of toolstone procurement could have been radically different than previously thought.

Another way technological organization is understood at a site is through the reduction stages represented in each occupation. Reduction stages link an assemblage with primary reduction, seen most frequently at quarry sites, secondary reduction, the formation and reduction of blanks or prepared cores, and tertiary reduction, the maintenance of formed tools. Variables such as dorsal scar count, cortex, platform type, and flake size are accepted as informing on reduction stage. The assumption is that as a core or flake is reduced and worked, the amount of cortex and size of the flake will decrease, the number of dorsal scar counts will increase, and platforms will become more complex. By measuring these variables, a general idea of what stages of reduction are present can be formed and then linked with larger patterns such as mobility or raw material maximization. Maximization and conservation of raw materials can be seen through high frequencies of platform preparation, low percentages of cortex coverage, and a preference for nonlocal materials for formal tools.

Binford (1980) separates mobile strategies into two categories each with their own site types an expected outcomes. A foraging system is characterized by residential mobility. In other words, residential bases are frequently moved from place to place throughout the year in order to better position people across the landscape for the acquisition of resources. Typically resources are gathered on encounter basis with a lesser dependence on storage. Two site types found in foraging societies include residential bases and extractive locations. Residential bases have variable assemblage sizes and an abundance of toolstone types. Shott (1986) also argues that people who are highly mobile will produce fewer types of tools than people who remain sedentary for longer amounts of time. This then implies that the residential bases are occupied for longer periods of time. Extractive locations generally have a small assemblage size with low variability of raw materials and tool forms. A high degree of redundancy, seen through fewer specialized activity areas within the site, may reflect higher degrees of mobility. Contrasted with foraging societies are collectors who are logistically mobile. Resource procurement is logistically organized following direct procurement strategies. In relation to this, food storage becomes very important in logistically mobile populations (Binford 1980:344). Collectors also have residential bases with high tool diversity and extractive locations with low tool variability, but with the addition of field camps (medium tool diversity), stations (low tool variability), and caches in the list of site types. A lower degree of redundancy , that is specialized activity areas within a site, may reflect a higher mobility in collectors.

For site occupation length Kuhn (1994) created a model based on the ratio of local and nonlocal lithic raw materials in an assemblage. Assumptions include that the discard of artifacts with long use-lives should be low for short term occupations. As occupation span increases, the discard rate of tools should increase. This is supported by Schiffer and Skibo (1987:55) and Surovell (2003) and others (Rolland and Dibble 1990). Discarded tools at short-term residential sites should also be dominated by nonlocal materials and indicative of raw material conservation (Surovell 2009:77). Intensive reduction and raw material conservation can be measured by platform preparation, greater percentage of smaller flakes, and a lack of cortex.

While technological organization represents a key framework to evaluate lithic variability, issues still remain. There is still no standardized method to guide researchers in their study of lithic and behavioral patterns (Andrefsky 2009). Underlying concerns with the use of analogy permeate the literature and could weaken the assumptions and conclusions drawn (Wylie 1985:139; 1988). Unclear definitions of terms as well have led to near chaos concerning the use and implications of terms like curation (Nash 1996; Nelson 1991). Other issues include the recognition and definition of variables. What should be measured and how do we measure it? Also, as with any study in archaeology, there are issues with the nature of the archaeological record. The record of the past is always coarse-grained, and measurements of parameters including risk, resource location and economy are difficult to clearly obtain. For example, proximity to raw material is a key variable in separating between expedient and curated technologies however proximity may not be able to be identified. Similarly, the study of technological organization seems to be dependent on the clear cut boundaries between two technological strategies or reduction stages, but if multiple technological strategies and reductions stages were present, the record would not yield data consistent with one strategy and complicate any following inferences. This is a relevant problem at the Mead site where evidence of continuous reduction from core to tool is present. In order to counter these biases, I have combined the use of standard variables that have been shown in the literature to provide robust relationships, with well-tested approaches to debitage analysis.

In order to understand the technological organization patterns exhibited at Mead, methods of analysis, specifically the Modified Sullivan and Rozen Typology as well as Attribute Analysis, were employed in order to draw inferences from the raw data about past behaviors.

2.1.2 Problems and Hypotheses

1) *Can components be clearly defined stratigraphically*? Does each component at Mead represent an individual occupation or a palimpsest? In order to determine if lithic variation between occupations is the result of behavioral decision-making, components must first be clearly defined. The delineation of components and testing of their separation is achieved by the use of visual separation according to clear breaks in stratigraphic profiles, as well as radiocarbon dating. If multiple features in one component return two different dates the component could potentially be a palimpsest, however if dates overlap, than the component likely represents an individual occupation.
2) *How is lithic technology organized?* This research question is subdivided using the concept of tool use-lives; from procurement through manufacture, use, re-use, and discard (Andrefsky 2008a; Kelly 1988; Nelson 1991; Schiffer 1992). Lithic procurement has generally been classified as embedded or direct, with implications for overall mobility in foraging societies (Andrefsky 2009; Bamforth 1990; Brantingham 2003; Gould and Saggers 1985; Odell 2000; Seeman 1994). Patterns consistent with embedded procurement include a shift in reliance to local materials as well as caching behavior. This will be tested through ratios of local to nonlocal materials in both debitage and tools. Patterns consistent with direct procurement include emphasis on nonlocal materials and conservation of tools made from them. This will be tested through ratios of local to nonlocal materials in tools as well as edge angle, and percent utilized for quantification of conservation on a tool form. Manufacture of tools and flakes has generally been dived into three reduction stages: primary, secondary, and tertiary. The presence or absence of reduction stages can inform on locality of a specific raw material but also on types of reduction occurring at the site which can then imply site use (Andrefsky 2005; Crabtree 1972; Dibble and Whittaker 1981; White 1963). Patterns consistent with primary reduction include high percentage of cortex, large flakes sizes, simple or cortical platforms, and low dorsal scar counts. These will be tested through cortical coverage and maximum flake dimensions, dorsal scar count and platform type. Patterns consistent with

late stage reduction include very low percentage of cortex, small flake sizes, high counts of dorsal scars, and complex platforms. Lithic analysis often includes a characterization of types of lithics strategies employed for the production of tools. Generally this is divided into expedient or formal technologies (Andrefsky 1994; Bamforth 1986; Cobb and Webb 1994; Torrence 1989). Patterns consistent with expedient technological strategy include high percentage of local materials for tools, and relatively little maximization of raw material and very little curation evident. This will be tested through local and nonlocal ratios of tools, quantity of formal tool types, measuring of percent utilization of each tool, as well as edge angle of each tool. Patterns consistent with formal tool strategies, such as microblade and bifacial startegies, include emphasis on nonlocal materials, heavy curation of tools and maximization of raw materials. These will be tested through quantity of formal tools types as well tools made on nonlocal materials, and the measuring of percent utilization of each tool, as well as edge angle of each tool.

3) *Are lithics spatially organized in specific patterns at Mead?* Is there variation among depositional sets that reflect different lithic activities? The degree of redundancy in activity areas has been shown to be associated with mobility patterns (Binford 1978). A high degree of redundancy may reflect higher degrees of residential mobility. However a lower degree of redundancy may reflect higher logistic mobility of collector societies (Kelly and Todd 1988) . Expected patterns consistent with redundant clusters include fewer specialized activity areas. Expected patterns consistent with low redundancy include many discernible areas with specialized activities. This will be tested by evaluating individual lithic activities in defined clusters by means of reduction stage, production type, material types, variability, and hearth association.
4) *Are there technological differences through time at the site?* Is there a shift in technological strategies between the different cultural components? In order for components to be compared, a characterization of technological organization and spatial patterning is first necessary. Once these aspects of each component are understood, general comparisons can be made concerning behavioral activities. Differences between components will be explored by comparing procurement patterns, differing use of local or nonlocal material, activity types occurring, hearth association, and reduction strategies.
5) *What are the broader behavioral strategies represented*? How did the site function within the framework of larger mobility patterns? Mobility patterns have generally been divided into

residential mobility (foragers) and logistic mobility (collectors) (Binford 1973, 1977a, 1979, 1980). Patterns expected for residentially mobile groups include encounter basis resource gathering, and a lesser dependence on storage. For residential base site types pattern include a variable assemblage size and abundance of toolstone types. For location or extractive location site types, patterns include a small assemblage size with low variability of tools and toolstone. Patterns expected for logistically organized groups include logistically procured resources, with a greater emphasis on food storage (Binford 1980:344). For logistically organized residential base site types patterns expected include high diversity of tool forms. For logistically organized extractive locations a low variability of tool form is expected. For field camps medium tool diversity is expected and for stations low tool variability is expected. To test for these mobility patterns and site type a general characterization of procurement patterns will be undertaken, as well as quantification of formalized tool forms, assemblage size and variability of raw materials.

6) *Does the technological organization at Mead correspond with previous central Alaskan research?* Is technology organized at Mead consistent with other analyzed assemblages in central Alaska? Comparable research in central Alaska includes some form of lithic analysis and characterization of behavioral patterns of a site. Due to a historic focus on typological analysis and cultural designations (Cook 1996; Goebel and Bigelow 1996; Goebel et al. 1996; Hoffecker and Powers 1996; Hoffecker et al. 1996; Holmes 1996; Holmes et al. 1996), this type of analysis is not widely available, but is present for the Dry Creek and Gerstle River sites. Comparisons among behavioral patterns such as procurement strategies, mobility, occupation span, site function, and artifact density can be made. Additionally general patterns of lithic behaviors at Mead can be compared to patterns proposed for cultural traditions such as Palearctic and Northern Archaic traditions.

To address these questions, I used a combination of MSRT and Attribute Anlysis. These methods and statistical tests are described below.

2.1.3 Modified Sullivan and Rozen Typology

The Modified Sullivan and Rozen Typology (MSRT) is a method of debitage analysis that uses flake completeness as a variable influenced by type of reduction strategy. In this approach, lithic debitage are defined as flakes, flake fragments or broken flakes, and shatter. Debitage does not include products of specialized strategies such as microblades and burin spalls. Initially the Sullivan and Rozen Typology (SRT) was proposed as a way to analyze debitage without the use of subjective characterizations of flakes (Sullivan and Rozen 1985). The main problem they reduce is subjective and often misclassified typologies. To counter this, they focus on easily operationalized flake typologies of completeness. Two case studies, the TEP St. Johns project and the Pitiful Flats study, show the effectiveness of their method. After criticism of the implementation of this technique (Amick and Mauldin 1989; Ensor and Roemer 1989), Prentiss (2001) wrote a critical review on the limitations of SRT, namely that other variables may affect the frequency of broken flakes, flake fragments, complete flakes and shatter. He then presents the MSRT as a solution to this problem. MSRT includes the characteristic of size classes (very small, small, medium, large, and very large) into the original typology, making the original five debitage classes into 20. Inferences that can be drawn from this model have been linked with experiments. Core reduction and flake production should result in higher frequencies of complete flakes, split flakes and shatter. Tool production should result in higher broken flake percentages. However, broken flakes can also indicate taphonomic disturbance like trampling damage. Production of medium to small bifaces produces size classes of small, medium, and large flakes with a high number of flake fragments, reduced number of broken flakes, and very low frequencies of complete and split flakes in the small categories. High frequencies of complete flakes are also expected when platform preparation is being employed. A large amount of complete flakes and shatter is interpreted to be indicative of core reduction. Expectations for core reduction can be further divided by core size. Reduction of large flake cores is expected to produce large complete flakes as well as medium shatter and split flakes. Medium flake core reduction should produce high numbers of medium sized flakes and small frags and shatter. Expected outcomes for pressure flaking are limited to high frequencies of small split and broken flakes. Reduction with a soft hammer produces an exceptionally high amount of small flake fragments either in biface production or core reduction. These inferences made from Prentiss' experiments, in conjunction with other lines of evidence (see below), can be applied to the Mead assemblage and used to understand reduction strategies at the site.

2.1.4 Attribute Analysis

In this project Attribute Analysis, as opposed to aggregate or typological analysis, is one of the methods of flake analysis employed. Using Andrefsky (2005) as a guideline for applicable attributes and their definitions, specific variables were chosen to be measured based on three criteria: comparability, usefulness, and efficiency . Comparability means that each variable was evaluated for use in other research in order to make this flake analysis relevant to other site analysis. Usefulness means that every variable was evaluated for what it could potentially contribute to the understanding of the assemblage and its proven effectiveness in making inferences about lithic technology. Efficiency means that variables were only chosen if they did not require extraordinary amounts of time in relation the type of information they yield. If two variables can be measured that both inform on the same aspect of lithic reduction and one is very easy to measure and one takes much longer, the quicker of the two to measure would be chosen over the latter.

Attribute analysis was chosen over aggregate and typological analysis for a number of reasons. Aggregate analysis is typically employed when assemblages are very large and there is a finite amount of time for exploration and interpretation (Ahler 1989; Ammerman and Andrefsky 1982). While it is useful in determining reduction stages (Ahler 1989), aggregate analysis falters when trying to understand the type of tool produced or type of core reduced (Andrefsky 2001:12). Typological analysis was avoided due to a concern for objective descriptions of flakes that do not infer behavior (see Andrefsky 2005). Typological categories such as bifacial thinning flake, notching flake, and channel flake immediately convey some behavior behind their production. Unfortunately such classifications are complicated by ambiguous and varied definitions. Sullivan and Rozen (1985) and Redman (1998) have also pointed out the lack of replicable definitions in typological analysis. They also call into question the lack of clear definitions of typologies and characteristic used to define them.

Because Attribute Analysis can be tailored to specific research designs and because this method of recording and analyzing variables also makes it possible to conduct aggregate and typological analysis, it was chosen as the most flexible method of analysis. Many attributes have been linked with valuable information that can inform on technological behaviors at a site. Measurements of cortex have been linked to stage of reduction and type of tool produced (Johnson 1987; White 1963). Debitage size and weight has been linked with raw material source locations (Beck 2008; Close 1996; Sassaman 1994). Platform type and morphology has been used to differentiate between core reduction and biface reduction, and type of hammer used (Odell 1989; Parry and Kelly 1987; Shott 1994).

What is important to emphasize is that no one method of flake analysis is sufficient to draw strong inferences from. Likewise no single variable can definitively show what stage of reduction occurred, what type of hammer was used, etc. By using both MSRT and Attribute Analysis, and ensuring that multiple variables are used for single inferences, this research aims to strengthen the inferences made using these multiple lines of evidence. For a complete list of all attributes measured see Appendix B.

2.2 Statistical tests

In order to interpret data and results yielded during this project statistical tests for significance are employed: Pearson's chi-square, Fisher's exact test, ANOVA and Tukey's post hoc test. Pearson's chi-square tests significance between variables with an expected cell outcome that is greater or equal to 5. The test was used for nominal, ordinal, and binomial data such as artifact type, cortex, presence or absence of eraillure scar, etc. The significance is determined at the 0.05 level and is two-sided. Where the expected outcome of a variable is less than 5, Fisher's exacts test is used. Fisher's exact test is used for nominal, ordinal, and binomial data and is measured at the 0.05 level. When variables such as weight, dorsal scar count, utilized percent, etc. are tested for significance an ANOVA test can be used. Both the one-way and two-way ANOVA tests are used in conjunction with Tukey's post hoc test in order to determine which variables are significantly different from each other. When there are less than 15 flakes in a sample being tested for significance, a t-test is used for ratio level data. Significance is measured at the 0.05 level.

2.3 Field Methods

The two seasons of excavation described in this project took place in 2009 and 2011 as part of the University of Alaska Fairbanks Archaeological Field School. Both excavations began on May 18th and ran until late June. A 1 x 1 m arbitrary grid pattern was applied to the site; each 1 x 1 m area was referred to and labeled as a unit and a 2 x 2 m excavation area was labeled a Block. A single datum was set up for each Block. A total station was used to 3-point all in situ artifacts, the total station was set up and calibrated at the beginning of each day by using a back shot to a datum point oriented directly grid north. Excavators took care to 3-point as much as possible, when a total station could not be used due to line-of-sight issues, hand 3-pointing was conducted. All excavated sediment was first screened for any remaining artifacts using a 1/8 in screen. In order to obtain the most constrained provenience possible even when an artifact is not 3-pointed, sediment was screened by 25 x 25 cm quads and 5 cm levels. In order to ensure that no artifacts were missed, all students' screens were checked by an experienced field excavator until it was established that they could detect artifacts unaided. When artifact concentrations were extremely dense and enough 3-points had been taken, the whole concentration would be bagged for later screening in the lab. This only happened in two instances in 2011, both concentrations were in a 15 x 15 cm area with well over 300 flakes. Likewise, all hearth material and feature sediment was bagged for later screening or floatation in the lab. Artifacts were labeled by Block and then field specimen (FS). Each Block was excavated by two students who shared a running sequence of FS numbers.

Excavations were done primarily by hand troweling, however the C2 horizon has about 40 cm of sterile sediment. After two levels of sterile excavation in this horizon, excavators were allowed to skim shovel. At the end of each excavation profiles were recorded where possible (Figure 3.2). Excavations were conducted in contoured arbitrary levels. Each level was 5 cm and followed the natural slope of the original site surface. Any overburden from previous excavation was first removed before taking surface measurements. When artifacts were present, as many as possible flakes or bones were pedestaled and photographed in order to better represent the full scatter. Additionally photographs of all features, scatters, large artifacts were taken. A photo log was also kept for the site.

2.4 Lab Methods

Artifacts bagged for later screening in the field were screened in the lab using geologic sieves. In order to remain consists with field collection methods flakes found in the 1/8th in screen were screened and bagged separately from flakes found in the 1/6th in screen. Bags containing feature matrix were screened to obtain charcoal fragments for radiocarbon. During cataloging and flake analysis stone artifacts were cleaned with a dry soft bristle. Bone fragments were cleaned using a dry, grade four, flat-bristle paintbrush. All artifact information including description and provenience information was checked for accuracy by cross-referencing bag information, field log information, and total station logs during cataloging. All artifacts are currently housed in the UAF archaeological laboratory. Any flake with a maximum dimension less than 0.3 cm was not included in the study. The list of attributes recorded in this study for all artifacts classes (debitage, biface, uniface, microblade, burin, burin spall, modified flake, and flake core). All characteristics recorded were chosen specifically to answer questions concerning lithic strategies used at the site and for compatibility with other relevant research (see above).

Andrefsky (2005) divides chipped stone artifacts into two basic categories: detached pieces and objective pieces. Detached pieces are artifacts that were created as a result of manufacture and reduction, objective pieces are artifacts which have been modified in any way such as cores, bifaces, or modified flakes. For the purpose of this study the terms debitage or debris, and flake to will refer to detached pieces. This category may also include modified flakes that exhibit patterns of wear or retouch but were detached from a tool during sharpening or reshaping and not utilized as a piece by itself. Debris refers to pieces of material that are purposefully removed but not utilized.

Terms that can be classified as objective pieces in this study are core, biface, uniface, modified flake, burin or burin spall, and microblade. The term tool is applied to any object that has been used to work or modify other material. In order to be classified a tool an item must exhibit evidence of use. In this study a low-power approach to usewear is taken that recognized wear-patterns by the presence or absence of small flake scars using 0-40x magnification. However, some objective pieces are not tools but rather created with specific roles in reduction strategies and tool manufacture, and they do not require evidence of use. These items include burin spalls, microblades, cores and flake blanks and preforms. Detailed lithic analytical methods are also provided in Appendix B.

Chapter 3 Background

This chapter situates the Mead site in its physical and archaeological context.

3.1 Site Location and Setting

The Mead site is located on a 10 m high bluff overlooking Shaw Creek and the Shaw Creek Flats in the Tanana River basin. The site is on an ecotone between the Tanana Lowlands and the Yukon-Tanana Uplands (Wahrhaftig 1965). The Yukon-Tanana Uplands is comprised of low rounded ridgelines as well as mountainous terrain, also associated with thick accumulation of aeolian sediments (Pewe 1975). The lowlands are covered in alluvium from the Tanana River.

3.2 History of Archaeological Investigation

The Mead site is located on a south/southeast facing bluff edge that was used as a rock quarry during the 1950’s and 1960’s (Dilley 1998). Mead was recognized as an archaeological site in the early 1970’s however formal excavation at the site was first conducted in 1990 and 1992 when Holmes tested both the east and west lobes identified at Mead. Holmes found mostly debitage and bone fragments but his research allowed him to make initial observations concerning the multiple components at Mead. Holmes identified four Cultural Zones (CZ), CZ1 dated from 1,200 to 4,500 cal BP, CZ2 dated around 6,800 cal BP, CZ3 dated around 12,500 cal BP and CZ4 dated to around 13,500 cal BP (Holmes 2001). Due to differences in research questions and collection methods, artifacts from the 1990 and 1992 assemblage are not used in the analysis.

No work was done at the site between 1992 and 2009. Excavation began in 2009 (Potter et al. 2011) with a total of 52 m dug in both the east and west lobes of the site. In order to ensure a wide spatial context for the assemblage to be analyzed, only artifacts and results from the excavation of the East lobe at Mead, the largest contiguous excavation, will be included (Figure 2.3). One feature was recorded in the East Block with 2,306 debris flakes, 19 modified flakes, three microblades, and seven flake cores recovered.

Excavation was continued in 2011 supervised by Dr. Potter. Another 26 m were excavated (Figure 3.1) including the uncovering of the remaining half of a large hearth found in 2009. A total of eight features were uncovered including a large cache pit feature (Feature 2011-4) associated with CZ1b. Artifacts included 5,002 debris flakes, 49 modified flakes, three bifaces, one biface, two microblades, two burins, 2 burin spalls, and two flake cores.

It should be noted that a 2012 field season also occurred at the Mead site but the assemblage could not be included in the scope of this project. Although the lithic assemblage was excluded, in order to better delineate the cultural components at Mead 2012 feature data was used. More specifically, in order to obtain a confident date for CZ2, charcoal collected from a hearth (Feature 2012-4) during the 2012 excavations was dated. Additionally, a new cultural occupation uncovered in 2012 lead to the delineation of CZ3a and CZ3b from the original CZ3.

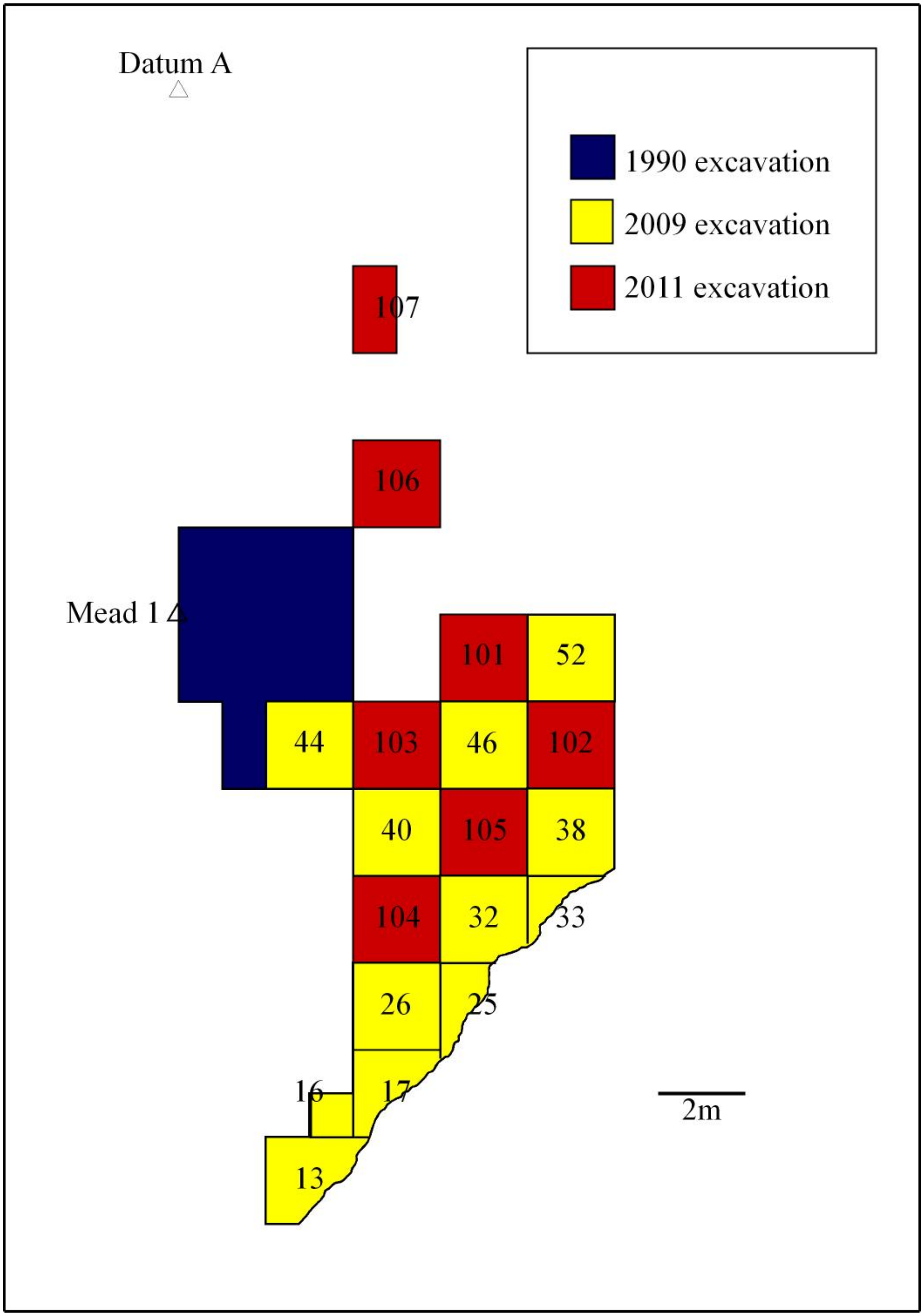

Figure 3.1 East Block excavation area as of 2011

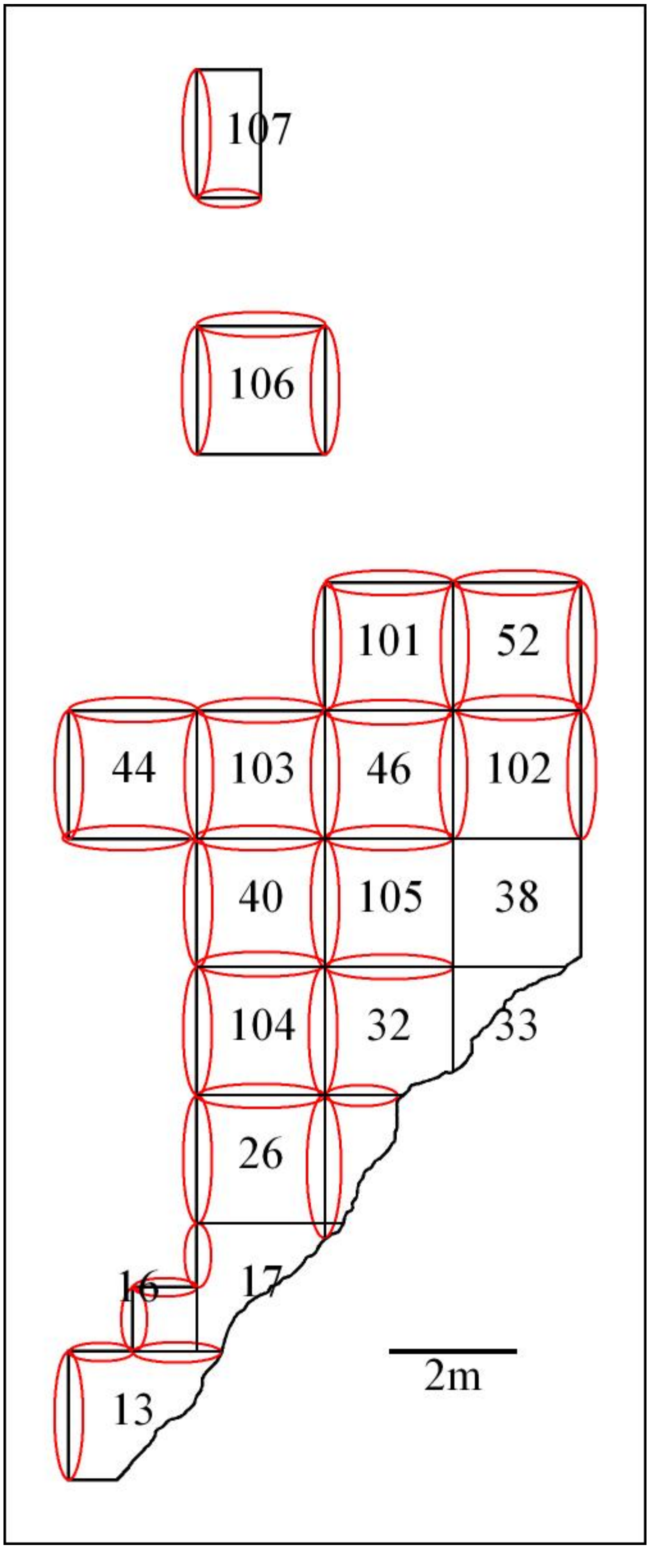

Figure 3.2 Stratigraphic profiles drawn for 2009 and 2011

3.3 Cultural Chronology

Central Alaskan Archaeology has the potential to answer many questions concerning the behavior of the first humans in America. The record offers windows into long-term adaptation and cultural change reflecting dynamic environmental and economic conditions. However, the current state of Alaskan archaeology is somewhat problematic. The prevalent theoretical paradigm at the time of the beginning of archaeological inquiry in Alaska has heavily influenced the approaches to archaeological research in the Subarctic. The surge of archeological research geared towards late Pleistocene sites was initiated in a theoretical framework of transition from cultural-history to early processualism. Although the processual paradigm and approaches have been strongly advocated by the broader North American archeological community, some Alaskan archaeologists tend to use a normative view of culture and focus on description and cultural typologies based on tool types. This theoretical background has limited broader intellectual concerns and questions about past lifeways in interior Alaska. This, in conjunction with larger problems such as ambiguous stratigraphy, radiocarbon problems and data gaps in the record, complicates research in the subarctic.

Another limitation to regional archaeological research is the intense focus on lithic tools. This is partly because lithic tools are seen as culturally diagnostic, and other sources of assessing contemporaneity such as relevant charcoal and organics, were difficult to come by the early years of Alaskan archaeology (Erlandson et al. 1991). The focus on lithic tools is also due to the prevailing framework of cultural-historical theory (Binford 1965, 1968; Caldwell 1959; Flannery 1967). Archaeologists operating under a cultural-historic framework typically view tools as culturally-diagnostic typologies that represent real cultural differences (Phillips and Willey 1953; Spaulding 1953). Following this, if similar tool types could be found in continuum through space and time, one could infer that a cultural continuum had also occurred (Lyman et al. 1997). Likewise, cultural discontinuity was inferred if tool types were not similar to each other. Because of this, migration, diffusion and replacement, all forces of change occurring from the outside, were often used to explain changes in archaeological assemblages (Trigger 2006:311). The growing need to explain cultural changes within a cultural group became apparent to archaeologists in the 1950’s. At the beginning of processualism or “New Archaeology,” in the 1960’s, archaeologists searched for ways to explain variability rather than describe it. They began to entertain the idea that characteristics of tools and other material remains may be subjectively created rather than discovered and began forging the science of archaeology.

Seminal papers discussing the shortcomings of the cultural historical framework (Caldwell 1959), and strength of processualism (Binford 1962, 1965) demonstrated to the archaeological community that new ways of approaching the record of the past provided the ability to explore, explain, and interpret meaning in a scientific manner. Over the next few decades, processualist ideas were reviewed, altered and strengthened and the “New Archaeology” took hold in North American Archaeology. However, Alaskan archaeology currently remains focused on descriptive research and cultural chronologies defined by tool typologies, seemingly unaware of the major theoretical and scientific leaps made in the 60’s and 70’s and the improvements of research techniques that followed.

The cultural-historical theoretical background can be seen in many early site excavations and interpretations of the central Alaskan archaeological record, and it persists throughout current projects (Dixon 1985; Powers and Hoffecker 1989). Early excavations such as the Campus site, as well as Healy Lake, Donnelly ridge, Teklanika East and West, and Walker Road, were entirely descriptive in their formation (Nelson 1935, 1937; Rainey 1939; West 1967). Using occupations found in these sites, descriptions were given based on variation in lithic type and shape, specifically presence and absence of microblades, and biface shape, and these differences were attributed to cultures.

Debate remains about the delineation of the Denali and Nenana complexes based on the presence or absence of microblade technology. Excavations at Swan Point helped to solidify the need for a microblade-absent Nenana complex, yet it also yielded the confusing discovery of an assemblage that dated earlier than the Nenana complex but was typical of the Denali complex toolset (Holmes 1998). Further complicating this finding was the unearthing of cultural layers at the Swan Point and Broken Mammoth sites that had Nenana assemblages in stratigraphic layers near the surface, indicating cultural continuity and contemporaneity with the Denali complex (Holmes 2001). It has been shown through radiocarbon dating that sites that do not have the typical Denali assemblage, should still be temporally categorized as Denali (Bever 2006; Dumond 2001). These complication have begun to show that the study of tools as cultural typologies is a largely unrewarding practice (Binford 1983, 2001), however some Alaskan archaeologists continue on with this cultural-historic framework.

In 1985 Dixon published an important paper setting forth a cultural chronology for the Alaskan interior. In it, he proposed five different cultural complexes: The Chindadn complex beginning around 13,000 years ago is based on the Chindadn and Nenana assemblages found at

Healy Lake and Dry Creek. The American Paleoarctic tradition beginning around 12,500 years ago is described as the Denali complex as labeled by West (1967, 1975). The Northern Archaic tradition begins around 6,000 years ago and is described by Dixon as a loss of microblade technology with the addition of notched points (although it has been demonstrated that microblades exist in this time and space as well (Esdale 2008; Potter 2008b). The Late Denali complex beginning around 4,000 years ago is the same as the regular Denali complex but Dixon separated it out in order to explain the apparent gap in microblade technology. Finally, Dixon ends the chronology with the Athabaskan cultural tradition beginning around 1,500 years ago (Dixon 1985). With this, the underlying paradigm of cultural-history once again comes to light. It is clear that Dixon's cultural chronology, as well as West and Dumond's attempts, all base their findings on what they believe to be culturally diagnostic tools. This persists throughout the following chronologies as well.

In 2001, Holmes set forth a cultural chronology based on tool typologies as well as radiocarbon dates and cultural migrations (expaned in 2008). Ultimately he argues for the use of "periods" rather than traditions as they are separated from cultural assignations and can encompass more variability than a tradition or complex. His chronology is as follows: The Beringian Period encompasses the Early East Beringian tradition and a small portion of the Late East Beringian Tradition (as described by West (1996)), which corresponds with the nenana/chindadn complex and the denali complex, respectively. The Transitional period spans the remaining portion of the Late Beringian tradition and most of the American Paleoarctic/Denali tradition. The Taiga Period covers a time frame from around 9,000 years ago to historic times, split into early, middle and late periods associated (generally) with the Transitional Northern Archaic, the Northern Archaic, and Athabaskan traditions respectively (Holmes 2001, 2008). While fairly useful in that the periods are somewhat separate from cultural descriptions and instead reliant on a number of defining factors, the varying methods used to derive the traditions ultimately complicate its application to research.

Alternatively Hoffecker and Elias (2007) offer a slightly different cultural chronology. Similar to Holmes (2008). Hoffecker and Elias also use a broad "Beringian" tradition encompassing all of variability into one comprehensive culture with local variants. They differ in that for the same time period as Holmes' Transitional period, they advocate for two separate cultures that are spatiotemporally contemporaneous: the Paleoarctic tradition characterized by the presence of microblade technology, and the Paleoindian tradition characterized by the absence of microblade tools and a focus of bifacial technology. The separation of these cultures based on tool typologies is once again reminiscent of cultural historic frameworks however Hoffecker and Elias also note that they believe the Paleoarctic tradition to have originated from northeast Asia and the Paleoindian tradition from a northward movement made by North American groups (2007:131).

Some central Alaskan researchers have embraced a more processual approach or at least have leaned away from tool typologies as culturally diagnostic and started looking at other explanations for toolkit variability. For example: Ackerman (2001) suggests microblades are associated with bow and arrow technology and bifaces with spear or other thrusting technology. Some suggest microblade technology is a risk minimizing strategy designed to conserve raw materials (Bamforth and Bleed 1997; Elston and Brantingham 2002; Flenniken 1987). Bever (2001) and others (Hoffecker 2001; Powers and Hoffecker 1989) consider that the presence or absence of microblades may indicate different patterns of site function due to seasonal variability or site habitat. While Bever did not go on to demonstrate this, Potter (2008b, 2011) effectively shows that a number of factors may explain the perceived dichotomy between microblades and non-microblade toolkits other than cultural differences. Potter has demonstrated that variables such as habitat (2005, 2008b), specified prey, weapon systems, and seasonality (2011) may determine where microblade technology is employed. In addition to these advances in the approach towards lithic variability, other more robust analytical approaches to understanding behavior and organizational patterns in the archaeological record have been increasingly applied in central Alaska.

Although a few researchers have begun to investigate economic models of delineating cultural complexes in central Alaska (Potter 2000, 2005, 2008a, b, 2011; Potter et al. 2007; Wygal 2011), cultural complexes are most commonly defined using tool typologies and differing technology as the basis for their separation. For this project, cultural designations to each occupation zone will not be emphasized, however in order for this research to be comparable to others some conclusions about cultural traditions must be drawn. It is therefore necessary to outline the definition of each cultural complex in this paper.

3.3.1 Swan Point/Dyuktai

Holmes (2001) characterizes the Swan Point or Dyuktai phase in the Early Beringian Period of Alaskan archaeology primarily by abundance of microblade technology. This cultural complex is the oldest defined in central Alaska with dates coming mainly from the lower occupations at Swan Point, Broken Mammoth, and Mead (CZ4) although only Swan Point has microblades in its lowest component.

3.3.2 Nenana

Powers and Hoffecker (1989) defined the Nenana complex using assemblages found at Dry Creek and Walker Road. The criteria for the Nenana complex are the absence of microblade technology and the presence of bifacial projectile points (Powers and Hoffecker 1989). A similar contemporaneous complex was defined by John Cook (1969) using artifacts from the Healy Lake site. The Chindadn complex is defined by the presence of teardrop-shaped projectile points called Chindadn points. Many of these points are present in occupations assigned to the Nenana complex, but the deciding factor continues to be the absence of microblade technology (Powers and Hoffecker 1989:278). This cultural tradition is contemporaneous with CZ4 at Mead although the assemblage does not fit with expected patterns.

3.3.3 Denali

Although the Campus site, found in the early thirties, represents one of the defining Denali sites, it was not until the sixties that that the Denali complex would come into actuality. When Frederick Hadleigh-West (1967, 1981) excavated the Donnelley Ridge site, the distinct wedge-shaped microblade cores, Donnelly burins (flakes used as burins) and bifacial knives lead him to believe that cultural components containing these tool types consisted of a homologous culture shared between Donnelley and the Campus site, as well as the Teklanika East and Teklanika West sites. Due to the resemblance of these artifacts with the Dyuktai culture found in Western Beringia West (1967) also believed that the Denali complex would date much older than previously found in Alaska, however new dates acquired on the site as well as at Campus and Teklanika West suggested otherwise. Dates on Donnelly Ridge were found to be much earlier than West had predicted however these dates remain disputed by some (West 1967) and accepted by others (Shinkwin 1979). Campus was re-dated to the Mid-Holocene by Mobley (1991) as well as Pearson and Powers (1999, 2001) once again shifting the Denali complex to a more recent period than previously thought. Likewise, Teklanika West was dated to a more recent date of around 7,000 BP (Goebel 1992, 1996). However, the last few decades of archaeology in central Alaska have revealed many more sites containing Denali assemblages broadening the age of Denali to what West may have first expected. Although microblades, the defining lithic of the Denali complex, continue to surface throughout the archeological record into the proto-historic era, Dixon (1985) and Hamilton and Goebel (1999) agree that the Denali complex officially ends at around 7,800 cal BP. The Denali complex is related by radiocarbon dating to CZ3a, CZ3b, and possibly CZ2 at Mead.

3.3.4 Northern Archaic Tradition

Douglas Anderson initially described the Northern Archaic Tradition in 1968. Like other traditions defined in Alaska, it is ambiguously defined and remains a complicated cultural typology. The Northern archaic tradition is traditionally defined by characteristic tool types, in this case lanceolate projectiles, end scrapers, and notched projectile points. Microblade and burin technology is also associated with the Northern Archaic tradition, but the addition of notched points makes it unique (Esdale 2008). Once again the heavy reliance on tool types as cultural signifiers is revealed in Alaskan archaeology. Just as with microblade technology, the presence or absence of a specific tool type is shown to be problematic. Some have hypothesized that the introduction of notched points represents population replacement of previous cultures while others have suggested that the notched point technology arose from diffusion of technological innovation (Esdale 2008). Complications aside, the Northern Archaic cultural tradition continues to be utilized in Alaskan archaeology, however unexplained in its origins and relations to other cultures it may be. The Northern archaic tradition is temporaly associated with CZ1b and possibly CZ2 at Mead.

3.3.5 Athabaskan

The Athabaskan tradition is characterized by bone and antler tools as well as decorative items such as beads. Technology in the Athabaskan tradition also shifts to bow and arrow tools. Items such as boulder spall scrapers are also associated with Athabaskan technologies. This shift began around 1500 years ago and continued until the contact period (Cook 1975). Behavior attributed to the Athabaskan tradition involves reoccupation of camps resulting in the evidence of caching becoming more prevalent for this time period (Workman 1978). Due to the preservation of Athabaskan sites and close relation to ethnographically documented central Alaskan cultures, the Athabaskan tradition is relatively demystified when compared with Chindadn, Nenana, Denali and Northern Archaic traditions. No cultural occupation ate Mead is associated with the Athabaskan cultural tradition.

3.3.6 Discussion

While each tradition has expected patterns of lithics, such as absence of microblades, cultural occupations at Mead show that this is not always the case, thus demonstrating ambiguity among cultural typologies. A culture is not merely made up of its material culture but rather its behaviors. In other words, for an archeologist to begin defining separate cultures they must first look at the behaviors of the culture represented rather than just artifacts. Although this project intensely focuses on the characterization of lithics at Mead, a strong effort is made to rely on analysis of debitage as a way to infer behavior at the site and to understand how the site was used. By doing this rather than simply describing the tools and assigning cultures, an understanding of the function of the site and the differences in behaviors between occupation can being to unfold.

3.4 Paleoenvironment

Discussions about the paleoenvironment at Mead will be limited to climate events that may have affected human behavior at the site. This is in order to better understand the context of any changes seen in the technological or spatial patterning between the different cultural components at Mead. A general trend seen at Mead is that the cultural horizons, except for CZ4 seem to correlate with characteristically cooler climatic periods according to proxy data (Gilbert 2011).

The Bolling/Allerod period was a warmer and wetter era marked by a rise in dwarf birch and willow (Bigelow and Edwards 2001). Beginning at around 16,000 cal BP (Viau et al. 2008), this period is also associated with a discernible fall in megafauna (Haile et al. 2009) as well as the migration of the first humans in Beringia (Holmes 2001). Viau (2008) found that precipitation increased during this period, peaking at around 11,000 cal BP then promptly decreasing until about 8,000 cal BP. CZ4 at Mead occurs during this warming period.

The Younger Dryas is a cold event occurring from 12,900-11,700 cal BP (Broecker et al. 2010). Effects of the Younger Dryas are varied throughout Alaska (Kokorowski et al. 2008). The sand levels at Mead that are located above the grey bedded sands and within the lower levels of loess deposition at the site are associated with conditions consistent with the Younger Dryas event (Gilbert 2011). These sand levels attributed to the Younger Dryas also occur at other sites such as Dry Creek, Broken Mammoth, and Upward Sun River (Bigelow et al. 1990; Potter et al. 2008). In general, the Younger Dryas climate was cooler and drier than the present with varying periods of soil formation, loess deposition, sand deposition, and soil formation (Gilbert 2011). Dates of the Younger Dryas as well spatial assertion of the sand lenses with cultural materials correlate CZ3b, CZ3a, and possibly CZ2 with the latter part of the Younger Dryas.

The abandonment of the site after CZ3 correlates with a shift from Younger Dryas into the Holocene Thermal Maximum. This supports evidence that a cooler climate was more favorable for occupation at Mead (Gilbert 2011). Yesner (2001) notes that a depositional event occurred during Holocene Thermal Maximum and is characterized by increased loess deposition as well as a sand lens at Broken Mammoth. The dates correspond with an increase in loess accumulation at Mead during this time.

Chapter 4 Component Delineation

4.1 Introduction

Five cultural zones were identified at Mead, using artifact backplots, features, stratigraphy, raw material types, and frequencies of artifacts by level to separate out cultural occupations. Gilbert (2011) used both the east and West Block assemblages to delineate CZ1a, CZ1b, CZ2, CZ3, and CZ4, with CZ1a situated at the top of the soil profile and CZ4 closest to the bedrock. Subsequent excavations in 2011 revealed that CZ1a and 1b could not be clearly divided into two separate occupations. Additionally, CZ3 has been split into CZ3a and CZ3b following 2012 excavations. CZ3a was found to be represented in the 2011 assemblage in small frequencies.

Figures of all backplots are located in Appendix E. Backplots of Block 101 (Figure E-1) show a clear separation of components. CZ1b and CZ4 are both present and a single flake was identified to be in CZ3b making CZ3b in block 101 located about 70-80 cm BS. Points taken on hearth Feature 2011-6 not only show the slope of CZ4 but solidify any flakes in the backplot in association with it to the dates obtained for the hearth. Backplots for Block 102 (Figure E-2) also show a very clear single cultural occupation in the upper components, this is labeled CZ1b. Adjusting for slope in the lower cultural zones, the large vertical spread of the lower conglomeration begins to separate out into mostly CZ3b and a few CZ4 artifacts. Block 103 backplots are mostly unusable as the Block is disturbed by the large pit Feature 2011-4 (Figure E-3). Backplots of Block 104 (Figure E-4) reflect the large concentration of CZ2 materials found. The North backplot shows a small separation of material interpreted to be the separation of CZ1b and CZ2. The mixing here is most likely due to bioturbation as a large tree was located on top on this Block. CZ3b and CZ4 are best seen in the East backplot represented by three bone artifacts. It is likely that there is a representation of CZ2 in Block 105 (Figure E-5), however backplots and stratigraphy could not help in its designation. The two most prevalent components in the backplots are CZ1b and CZ3b. The backplots of Block 106 (Figure E-6) show the distinct separation of CZ3a. Again, turbation has mixed the upper components making CZ1b and CZ2 difficult to delineate, however in this case the upper conglomeration of artifacts in the Block 106 is mostly CZ2. Block 107 (Figure E-7) has an upper cluster of artifacts with a large vertical spread however there was no discernible break, so all upper artifacts have been labeled CZ1b. The lower cluster of artifacts was determined to be CZ3b. Blocks excavated in 2009 yielded relatively few artifacts compared to 2011 so their backplots are limited (Figure E-8 – Figure E-

19). However it should be noted that the backplots, even with so few artifacts, show a very clear separation between components, as expected of the well-defined stratigraphy at the site.

4.2 CZ1b

New radiocarbon dates for Cultural Zone 1b indicate an age of 4244-4008 cal BP. This cultural zone is present throughout the East Block excavations and is found within the B horizon. Cultural artifacts consist of 3,934 flakes, 42 modified flakes, one burin, three microblades (two with edge damage), one burin spall with damage, and three flake cores. Obsidian flakes have been sourced to Batza Tena, Wiki Peak and potentially Group K. In 2009 CZ1b was separated from CZ1a, however after closer consideration of backplots, stratigraphy, raw material dispersion, and flake frequencies by level, it was determined that CZ1a and 1b likely represent the same cultural occupation. Mixing and transmigration occurred due to cryoturbation and bioturbation. The result is that there is one cultural occupation, CZ1, or CZ1b, spread throughout the upper 20-35 cm of sediment. There is a single cultural feature in this occupation identified as a cache pit. This occupation is spatially distinct due to artifact dispersal and density across the site.

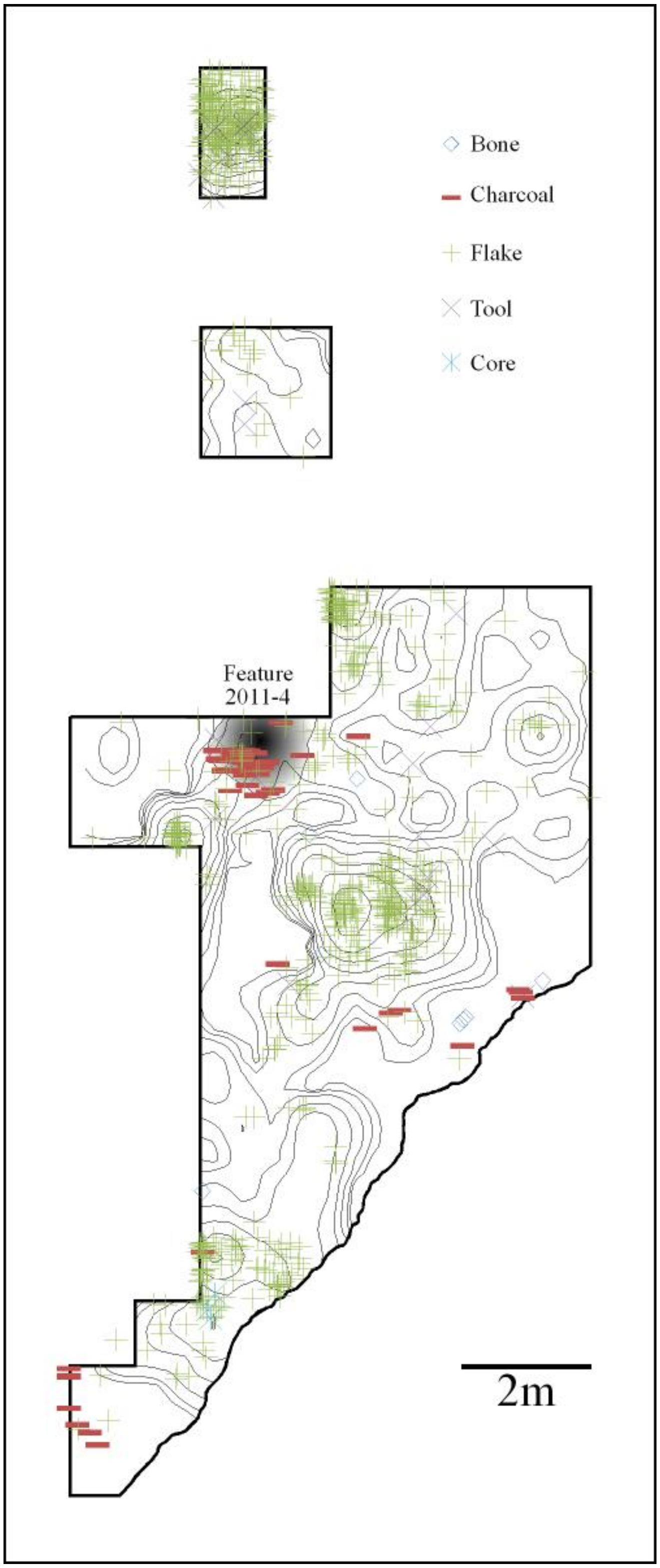

Figure 4.1 CZ1b 3-pointed artifacts with isopleth map of all flakes

4.3 CZ2

Cultural Zone 2 (Figure 4.2) is distinct when it appears, occurring between 10-20 cm below the lowest constraint for CZ1b in the B/C stratum. In the northern portion of the site, the separation between CZ1b and CZ2 is less clear than the southern portions of the site due to the slop of the site. CZ2 artifacts appear unimodal when looking at artifact frequencies by level, which is in contrast to the sometimes bimodal distribution of CZ1. Dating for CZ2 remains complicated. A hearth feature from 2012 was intended to be used, but two samples thought to be charcoal have proven to be insufficient for radiocarbon dating. However, concrete dates on both CZ1b and CZ3a have been obtained. Additionally stratigraphic dates on the B and C1 horizons further suggest that the dates of CZ are between 6900 cal BP and 8800 cal BP. CZ2 is unique in that it contains a high frequency of early-stage bifaces and lithic concentrations have clearly defined spatial boundaries. The 2012 excavations resulted in additional large concentrations of CZ2 including primary reduction activity areas and two hearths.

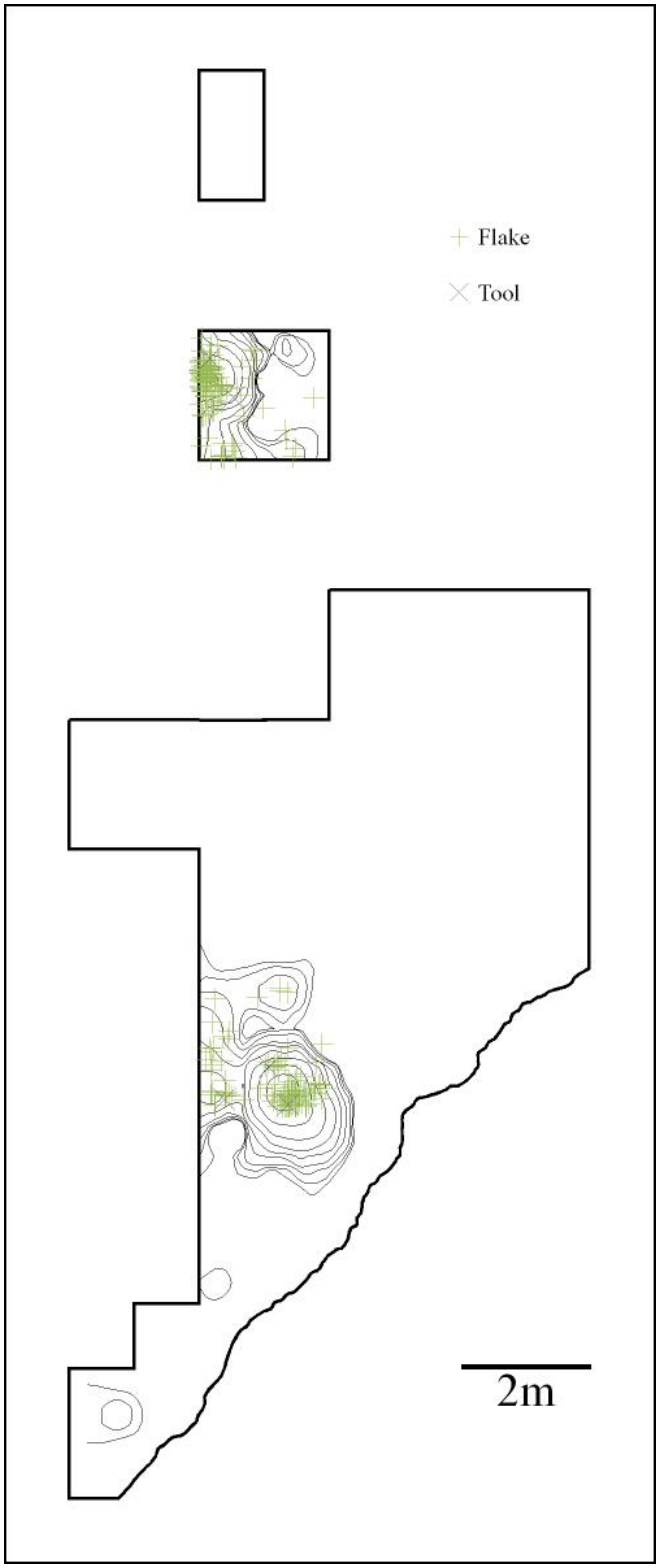

Figure 4.2 CZ2 3-pointed artifacts with isopleth map of all flakes

4.4 CZ3a

This cultural occupation was first recognized in 2011, but not clearly defined until the discovery of an associated hearth in 2012. The 2011 excavations uncovered a total of 13 grey chert flakes in the northeast unit of Block 106. Located well within the C2 horizon, CZ3a is at least 20 cm below CZ2 and 25 cm above the top of CZ3b. No dates have been obtained for this cultural zone but CZ3a is thought to be around 10,00kya based on the spatial relationship with CZ3b.

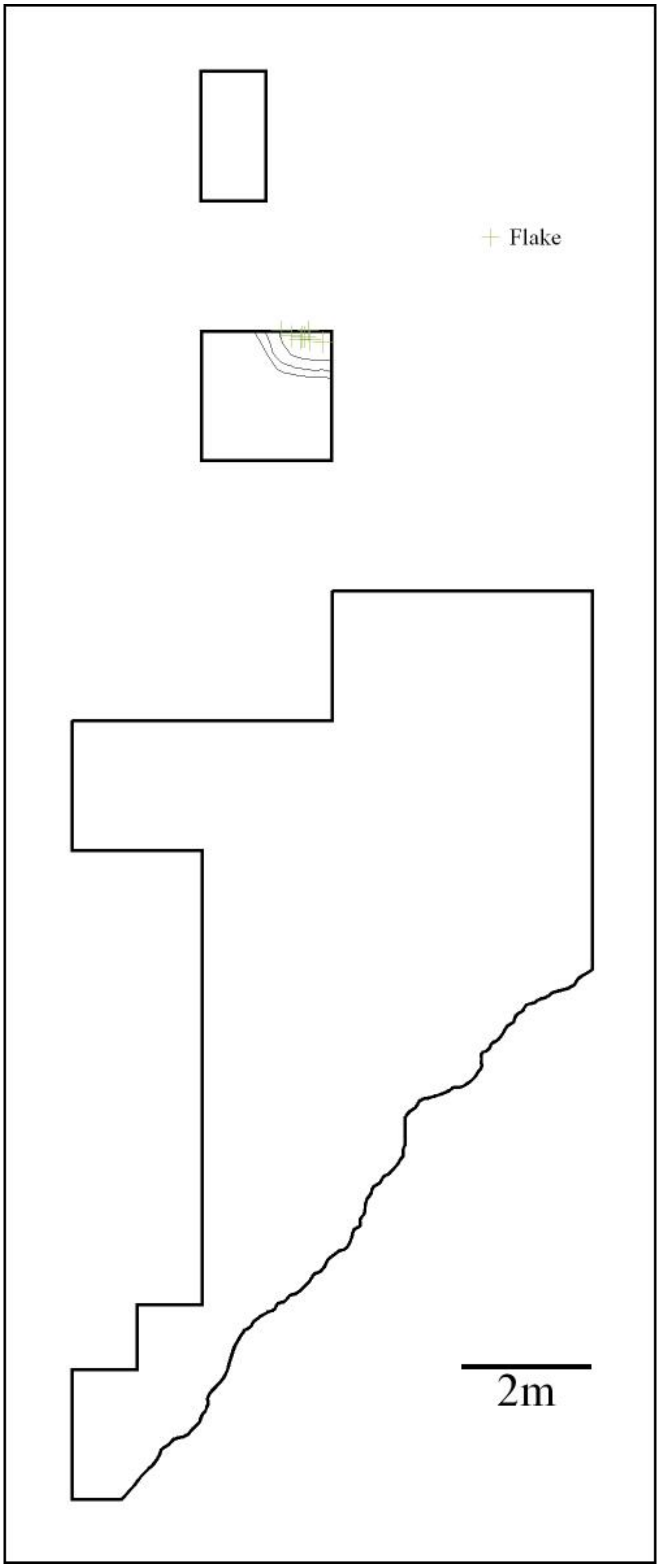

Figure 4.3 CZ3a 3-pointed artifacts and isopleth map of all flakes

4.5 CZ3b

Cultural Zone 3b (Figure 4.4) has a total of 480 lithics artifacts and 235 bones. The bones are largely constrained due to three hearth features (Feature 2011-8, Feature 2011-9, and Feature 2011-5). Because of the presence of multiple hearths, dates obtained for CZ3b are very reliable due to observed overlap in the dates. One sample of charcoal from each of the Features 2011-8, 2011-9 and 2011-5 have been radiocarbon dated. The average date of all CZ3b samples is 11,500-12,080 cal BP. Two obsidian flakes from this cultural level have been firmly sourced to Wiki Peak. General spatial observations show that artifacts clusters seem to be closely associated to hearth features. Also unique for this component is the presence of a two hearth features with only a few flakes associated, simultaneously occurring with hearth features associated with many flakes. This will be discussed in Chapter 6. General observations about the lithics in this component show that expedient tools are being favored along with an increase in the use of local high quality chert.

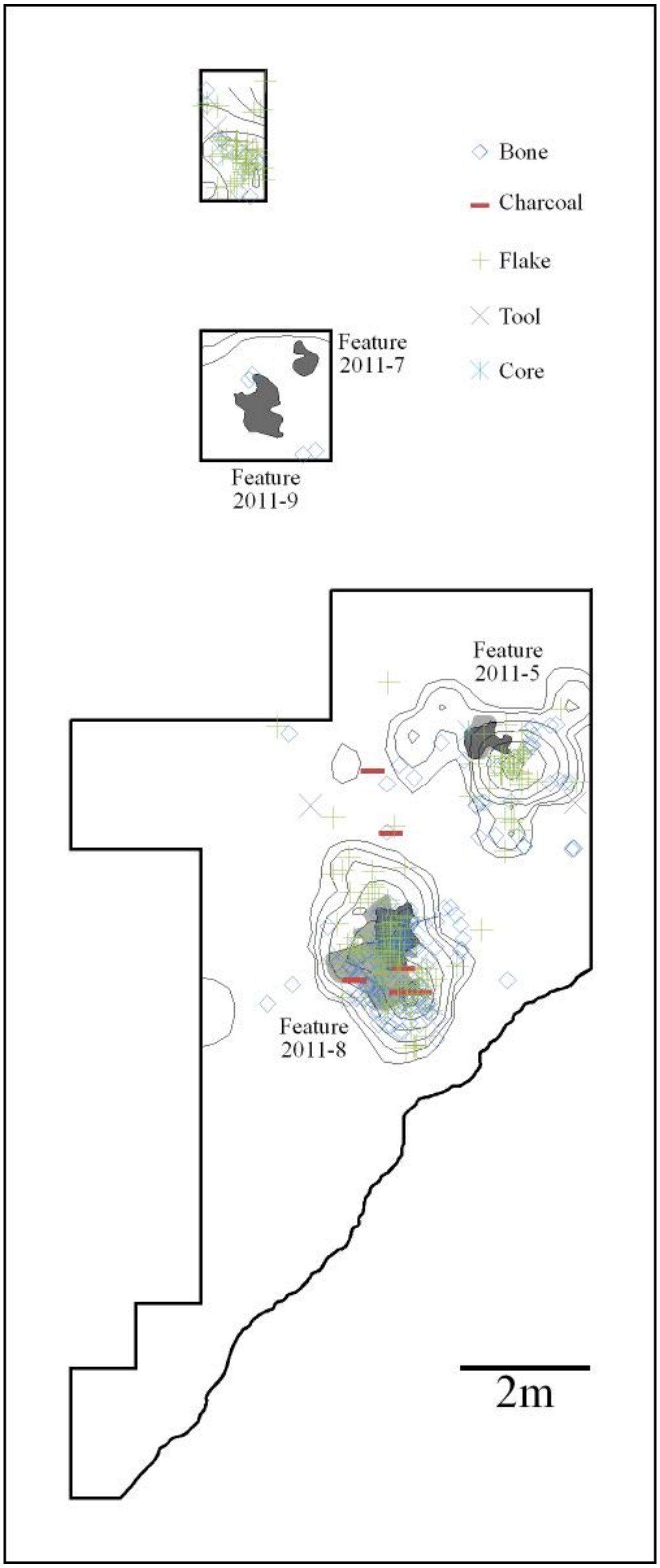

Figure 4.4 CZ3b 3-pointed artifacts with isopleth map of all flakes

4.6 CZ4

This cultural zone has 1,073 lithic artifacts and 134 bone fragments. Of the lithics,766 artifacts are made from a quartz material found locally at the site. CZ4 contains primary reduction of quartz cobbles found on the site with limited numbers of chert flakes. Notably, nearly all modified flakes and tools in this occupation are made from grey chalcedony. Five obsidian flakes from this cultural zone have been securely sourced to Wiki Peak. Dating for this cultural zone is based on two hearth features that average 13,130-12,750 cal BP. CZ4 is located in the C2 horizon, 5-15 cm below CZ3b (Figure 4.5 and Figure 4.6) and 5-20 cm above the grey bedded sands. Spatial observations show a similarity to CZ3b, where the occurrence of a flake-loaded and a flake-scarce hearth are simultaneously present. Notably however a large diffuse scatter of artifacts is present as opposed to only tightly constrained clustered observed in CZ2 and CZ3b.

Figure 4.5 Features 2011-9 (left) and 2011-10 (right) showing separation of CZ3b and CZ4

Figure 4.6 Separation of Feature 2011-5 (CZ3b) and quartzite scatter (CZ4)

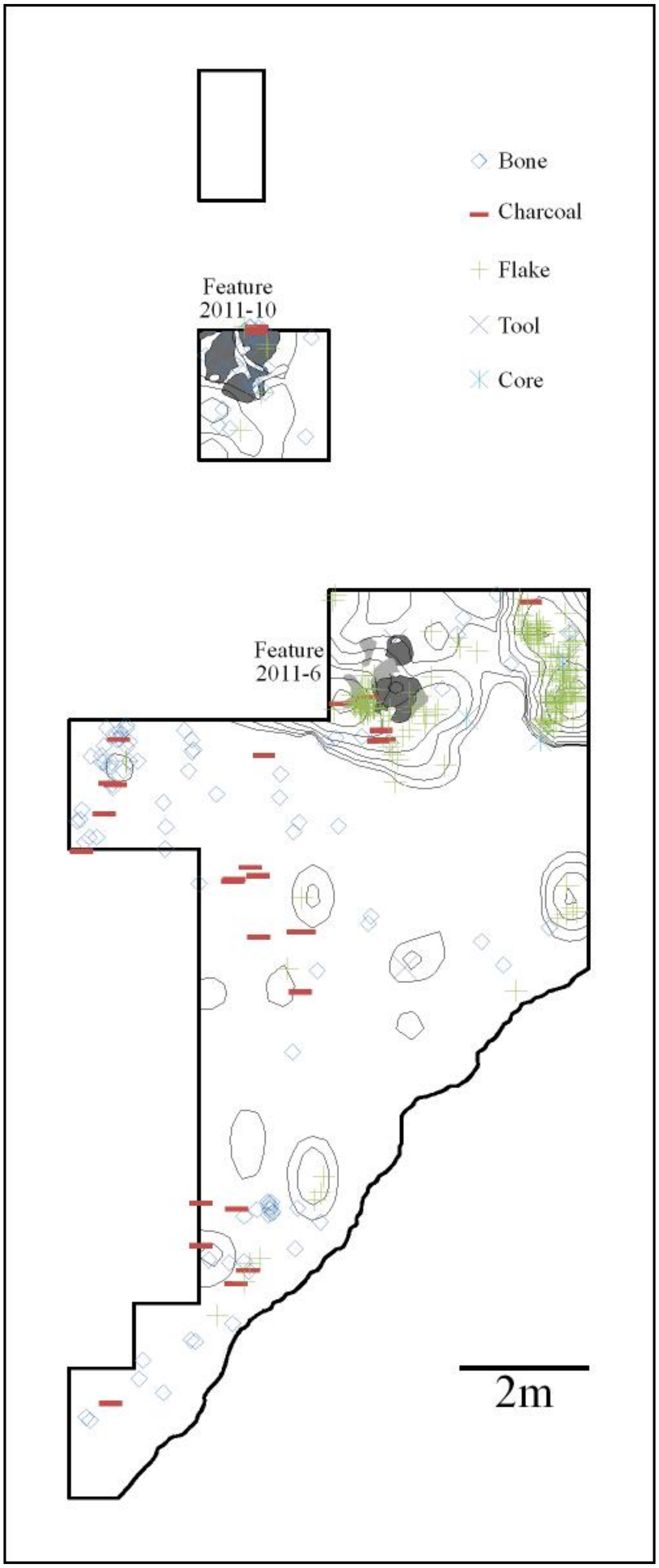

Figure 4.7 CZ4 3-pointed artifacts and isopleth of all flakes

Chapter 5 Lithic Artifacts

This chapter presents descriptive, classificatory, and analytical data on lithic artifacts and artifact attributes found at Mead. Technological analysis is presented in Chapter 9.

5.1 Material Types

Material types were first categorized using five attributes; for each flake, the Munsell color, luster, texture, homogeneity, and quality were recorded. After all flake cataloging was complete, raw materials were then defined using the ranges for each attribute to define broad material categories. A total of 17 material types were defined, totals for each material summarized by CZ are outlined in Table 5.1. For all components each material will be briefly described below. Detailed descriptions can be found in Appendix D.

Table 5.1 Raw material totals by CZ, all artifacts

Raw Material	CZ1b	CZ2	CZ3a	CZ3b	CZ4	Totals
andesite	1	0	0	43	38	82
argillite	3	0	0	0	0	3
banded chalcedony	14	10	0	52	7	83
black basalt	25	0	0	0	0	25
black chert	63	7	0	3	3	76
brown chert	19	3	0	1	1	24
brown quartzite	528	44	0	14	0	586
grey quartzite	265	8	0	12	0	285
grey basalt	15	0	0	29	7	51
grey chalcedony	16	5	0	50	55	126
grey chert	2488	1861	13	184	44	4590
jasper	3	1	0	0	1	5
petrified wood	0		0	1	0	1
obsidian	16	2	0	2	17	37
red/grey siltstone	0	0	0	0	8	8
rhyolite	574	6	0	0	0	580
quartz	3	2	0	111	775	891

Andesite: This is a medium-grained grey to dark grey material subjectively classified as fair quality. All specimens have a distinctly dull luster. A total of 82 artifacts made from this material were classified as andesite. Main signifier of andesite when comparing to grey basalt or dull grey quartzite is the presence of small black speckles in the material.

Banded Chalcedony: Banded chalcedony is a grey chalcedony with green, brown and black variations in color that has a distinct mottled black banding pattern in the material. The banding does not affect the fracture mechanics of the material. Color variations in lightness or darkness of grey largely due to the thickness of the specimen being analyzed. This material type has a distinctly waxy luster and is fine-grained and excellent quality. The main criteria used to define a total of 77 artifacts in this group is the banding appearing within the material.

Grey Chalcedony: Grey chalcedony is a classification that consists of all other chalcedony found at the site that do not show banding. Color is primarily grey with variations into green, white and brown hues. This chalcedony is waxy in luster, very fine grained and of excellent quality. A total of 118 pieces of grey chalcedony were recovered.

Black Basalt: Black basalt color ranges from very dark grey to black. This basalt has a marked dull luster and ranges from excellent to fair quality with textures ranging from medium to fine grained. A total of 25 artifacts were classes as black basalt. Main differences between black chert and black basalt: black chert and black basalt are both fine grained but chert is vitreous luster and black basalt is dull. Black basalt is mostly medium grained and dull with visible fracture planes.

Grey Basalt: Grey basalt is dark to light grey in color, it is fine to medium grained and has slight variation in homogeneity with subjective quality grading from fair to excellent. A total of 50 artifacts were made from grey basalt.

Black Chert: This raw material ranges from very dark grey to black in color. It can be dull, vitreous or glassy in luster and fine in grain texture. Homogeneity varies from 1-2 and quality likewise ranges from fair to excellent. A total of 73 artifacts were made from black chert 71 unmodified flakes and two modified forms.

Grey Chert: Grey chert by far makes up the majority of the stone artifacts found at the site. There are many color variations within the larger classification of grey including brown, blue, and red. Most notable one modified flake of a blue/grey chert is visually very distinct from the rest of artifacts classes as grey chert, but as the only one of its kind I have grouped it as grey chert for the purpose of analysis. Luster for grey chert is mainly vitreous, but can also by waxy, glassy, and dull. It can be fine to medium grained with level 1-2 of homogeneity ranging from excellent to fair in quality. A total of 4,560 flakes of grey chert were collected from Mead with 4,515 being unmodified flakes, and 42 tools.

Brown Chert: Brown chert has color variations from light to dark brown, with yellow and olive hues. Luster, texture, homogeneity, and quality range from dull to vitreous, fine` to medium, 1 to 3, and excellent to poor, respectively. A total of 24 brown chert flakes were recovered from Mead with 1 modified flake and 23 unmodified flakes.

Grey quartzite: Grey Quartzite looks very similar to brown quartzite but is distinctly grey or dark grey in color. Only a few specimens were fine grained while the rest were medium. Homogeneity ranges from 1 to 2 and quality has been defined as fair to poor. A total of 285 flakes were found all unmodified.

Brown Quartzite: The color ranges for brown quartzite very greatly with variations in intensities of yellow, red, brown, and grey. This material is of fair to poor quality due to its medium to large grained texture. It has a dull luster and homogeneity ranges from one to two. This material is found locally on site and of the 162 thermally altered artifacts found total, 48% are made from this brown quartzite. Brown quartzite has 13.3% of its total artifacts thermally altered, this is the third highest percentage not including jasper and petrified wood which have very low total counts at the site. Raw material types with no artifacts showing thermal alteration do not appear in the table. This material type is found in CZ1b, CZ2 and CZ3b.

Quartz: Cobbles of this material are found naturally at the site within the grey bedded sands above the bedrock. The cobbles found have a ventifacted surface however original cortex has been found on waste flakes. Both the ventifacted surface and original cortex were measured as cortex with the subtypes noted in a separate column. There are a total of 884 quartz artifacts. 108 have cortex on them with 19 artifacts (all debris) having original cortex and 88 having cortex in the form of the ventifacted surface. 1 flake has both types of cortex. This material type is very distinct, with large to medium quartz crystal grains, and a homogeneity range of one to two it can range from fair to poor quality. Luster is either vitreous or glassy. Colors come in different variations of white and grey with hues of brown and red.

Rhyolite: The rhyolite at Mead appears in dense clusters in Blocks 107 and 105 for CZ1b. This raw material is very brittle and many pieces were broken during recovery. Additionally the coloring of the material was observed to be based in part on the surrounding matrix. Because of this, the coloring of rhyolite varies greatly from different hues of brown, grey and red. The cortex found on the rhyolite at this site is a grainy pink rind cortex. This cortex matches the cortex found on similar rhyolite pieces found at Gerstle River which have been sourced as “Type X” rhyolite. Luster can be vitreous to dull with a fine-grained texture. Homogeneity ranges from 1 to 2 and likewise quality ranges from excellent to fair. A total of 579 rhyolite flakes were found in all components at Mead.

Other (petrified wood, red/grey siltstone, jasper): Materials included in this category have very little representation at the site. Jasper totals 5, red/grey siltstone 8, and petrified wood just 1. Both the petrified wood and red/grey siltstone have questionable origins and although categorized as flakes here, may represent natural fracturing rather than cultural use. The five flakes labeled as jasper were labeled so specifically because their deep red color. However 4 out of the 5 flakes exhibit signs of thermal alteration. It may be that the deep red color is due to heat treatment rather than raw material source however no other materials were observed to contain partially reddening in such a drastic way and therefore the red color is assumed to be a variance of raw material.

Figure 5.1 Andesite

Figure 5.2 Banded chalcedony

Figure 5.3 Grey chalcedony

Figure 5.4 Black basalt

Figure 5.5 Grey basalt

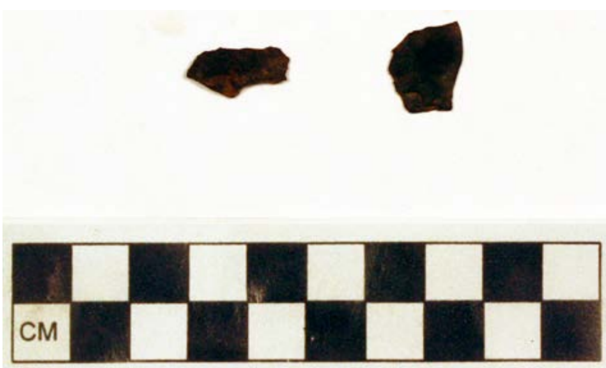

Figure 5.6 Black chert

Figure 5.7 Grey chert

Figure 5.8 Brown chert

Figure 5.9 Grey quartzite

Figure 5.10 Brown quartzite

Figure 5.11 Quartz

Figure 5.12 Rhyolite

Figure 5.13 Red/grey siltstone

Figure 5.14 Petrified wood (left) and jasper (right)

5.1.1 Obsidian Sourcing

A total of 26 obsidian flakes were analyzed using a portable XRF. Small and thin flakes do not have as strong of a chemical signature as thick and large flakes and are skewed when trying to trace them to a volcanic source therefore only 18 flakes have unquestionable sourcing. Of the 18 flakes with confident sourcing, eight come from Batza Tena, eight are from the Wiki Peak source and one flake each has been sourced to Group K and Group P. All Batza Tena flakes were found within CZ1b, however Wiki peak is found in all cultural zones where obsidian was present. Group K is within CZ1b and Group P from CZ2 (Table 5.2).

Cultural Zones 3b and 4 contain only obsidian from Wiki Peak while CZ1b and CZ2 contain all four types of Batza Tena, Wiki Peak, Group P, and Group K. Additionally CZ1b contains 4 out of the 5 utilized obsidian flakes, with the remaining specimen in CZ3b. This suggests that there are fundamentally different strategies for procuring and using obsidian at the site between the Late Pleistocene and Mid Holocene occupations.

Figure 5.15 Obsidian

Table 5.2 Obsidian sourcing results

XRF ID #	Artifact ID	Source	CZ
50225	101-149	Batza Tena	CZ1b
50420	102-69	Batza Tena	CZ1b
50422	105-157	Group K	CZ1b
4445	E32-11	Batza Tena	CZ1b
4436	E32-12	Batza Tena	CZ1b
4449	E32-14	Batza Tena	CZ1b
50425	E38-4	Batza Tena	CZ1b
4448	E40-7	Wiki Peak	CZ1b
4446	E52-13	Batza Tena	CZ1b
4447	E52-15	Batza Tena	CZ1b
50421	102-80	Wiki Peak	CZ2
50228	E13-13	Group P	CZ2
50428	E46-77b	Wiki Peak	CZ3b
50224	101-255	Wiki Peak	CZ4
50410	101-342	Wiki Peak	CZ4
50411	101-247a	Wiki Peak	CZ4
50415	101-247e	Wiki Peak	CZ4
50416	101-247f	Wiki Peak	CZ4

5.2 Local and Nonlocal Materials

Each raw material was examined for patterns within each cultural occupation; however a general designation of nonlocal and local materials can be done using data from the entire site. Only three material types have a known location, obsidian (nonlocal) and brown quartzite and quartz (local). The two quartzite materials mentioned are found on-site as cobbles, all other materials have no known locations. Because of this, results presented here are not final and any designation of a material as local or nonlocal when the source location is not known, is a supposition. In this project local is defined as being within 20km of the site and nonlocal as being farther than 20km from the site following Surovell (2009:78). Additionally, for some analyses I define the brown quartzite and quartz as "on-site" as a way to separate immediately available materials from materials available with some travel necessary. In order to further classify other materials as local or nonlocal, a few attributes were measured and compared. Materials that have been classed as local include quartz, brown quartzite, grey quartzite, and grey chert. All other materials were classified as nonlocal (Table 5.3).

Table 5.3 Raw material local or nonlocal summaries, categorized by weight percent

Raw Material	n	Wt. (g)	n%	Wt.%	Mod. %	Local/Nonlocal
quartz	884	3646.077	12	41.1	0.3	Local
brown quartzite	587	3061.69	7.9	34.6	0	Local
grey quartzite	285	979.57	3.9	11.1	0	Local
grey chert	4560	646.34	61.7	7.3	0.8	Local
grey basalt	50	199.84	0.7	2.3	4	Nonlocal
rhyolite	579	118.01	7.8	1.3	0.2	Nonlocal
andesite	82	103.07	1.1	1.2	0	Nonlocal
banded chalcedony	77	45.66	1	0.5	10.4	Nonlocal
grey chalcedony	116	22.08	1.6	0.2	7.8	Nonlocal
black chert	73	14.99	1	0.2	2.7	Nonlocal
brown chert	22	14.98	0.3	0.2	4.3	Nonlocal
obsidian	36	3.73	0.5	0	16.7	Nonlocal
black basalt	25	3.12	0.3	0	0	Nonlocal
red/grey siltstone	8	0.6	0.1	0	0	Nonlocal
petrified wood	1	0.34	0	0	0	Nonlocal
jasper	5	0.3	0.1	0	0	Nonlocal

When comparing the total weight of each raw material against the percent of modification for each material, the observed pattern for obsidian and quartz can help to sort the other materials as local or nonlocal. In Figure 5.16 it can be observed that obsidian has a very high percent of modification and low total weight, while quartz has a very low percent of modification and high total weight. Because these sources are known, it can then be inferred that other materials containing similar ratios of modified percent and total weight should be classed similarly as local or nonlocal. The two sources classed as local that do not have known sources are grey chert and grey quartzite. The grey quartzite is very similar to the on-site brown quartzite in texture, grain size, quality, and fracture mechanics, with the main difference being color. This may suggest that the grey quartzite and brown quartzite are from the same source and the grey material of the on-site quartzite has not yet been located in the site. Additionally the grey chert is defined as local but there are no cores of this material found in 2009 or 2011. However in 2012, river-rolled chert cobbles were excavated, providing strong evidence that modified percent within each material compared to the total weight has classified local material correctly.

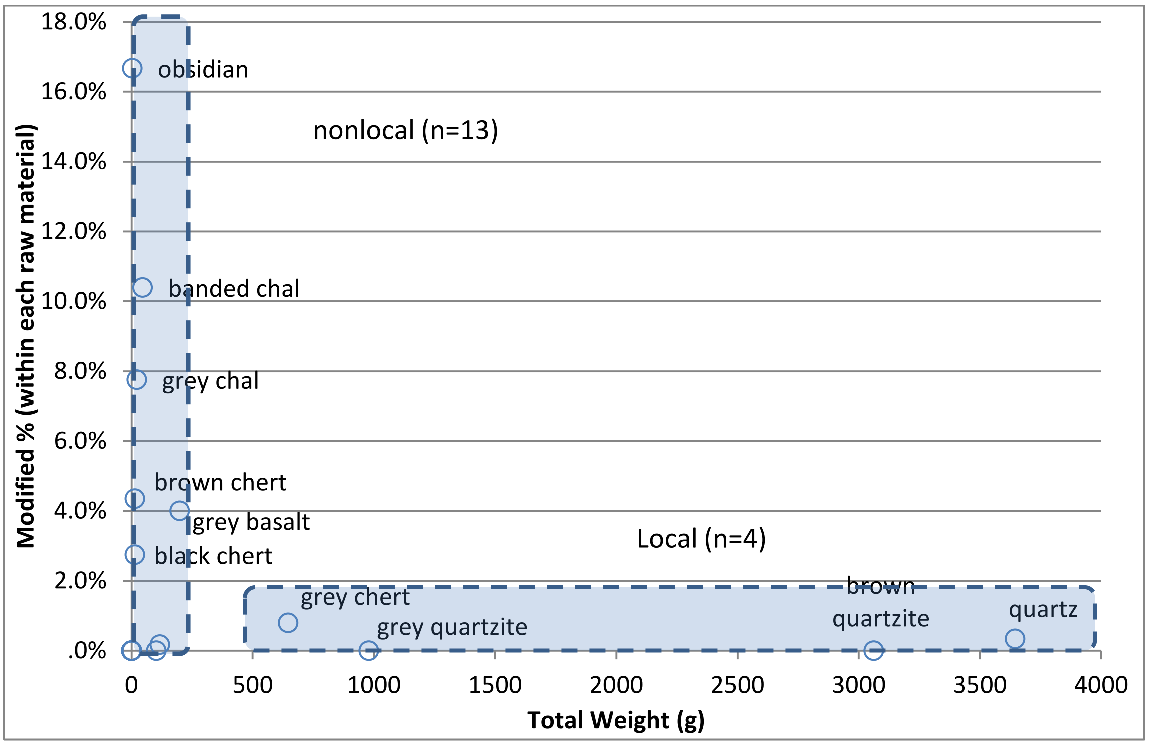

Figure 5.16 Raw material type by modified percent and total weight

When comparing the percent of total flakes against the total percent of weight of a raw material, a similar pattern emerges. The grey quartzite, brown quartzite, quartz, and grey chert are classified as local while other materials are nonlocal (see Figure 5.17).

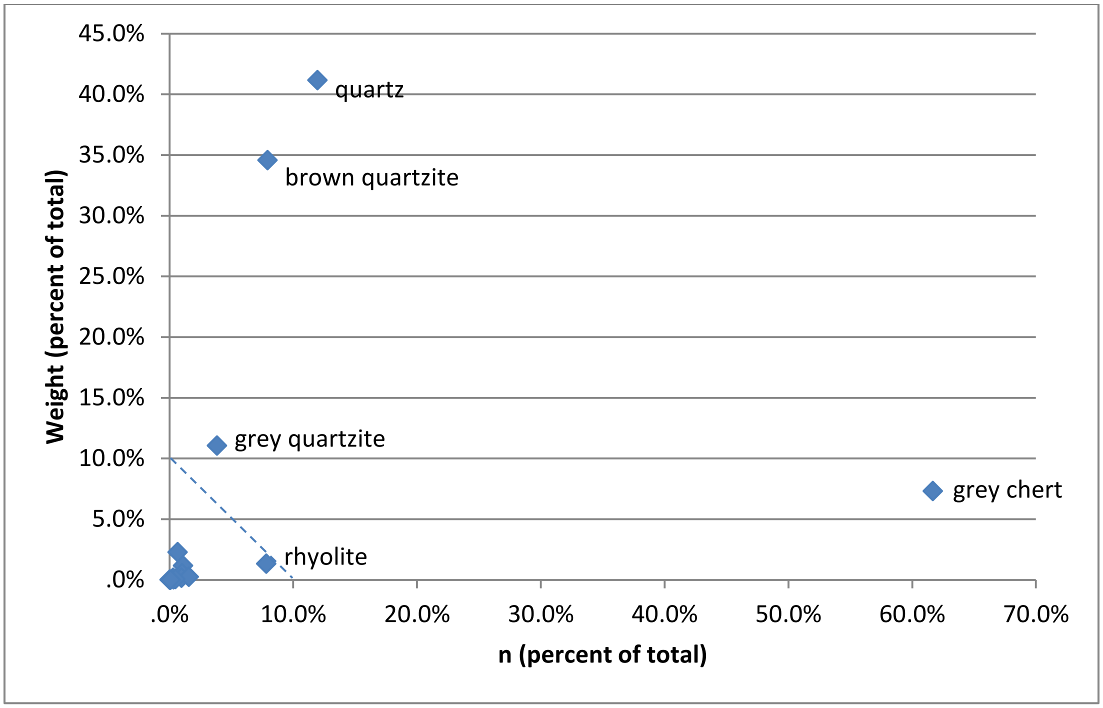

Figure 5.17 Raw material type by number and weight

The classification of rhyolite as a local or nonlocal source requires further inquiry. When comparing percent of total frequency and percent weight for rhyolite against other materials (Figure 5.17) rhyolite is intermediate. Additionally the material has a very low modified percent and higher percent weight than almost all other nonlocal materials (Figure 5.16). To better place rhyolite in a category as local or nonlocal flake scar counts and percent cortex were analyzed in comparison with a known local material, quartz, and known nonlocal material, obsidian. A high frequency of flakes with cortex in a single raw material category is typically interpreted as a marker that the material is found locally (Andrefsky 2001:11). When comparing cortex at Mead, 6.7% of obsidian flakes have cortex present, all with fewer than 50% cortex. A total of 11.8% of quartz flakes have cortex present, 7.3% of which have 100% cortex. In comparison rhyolite has similar percentages to obsidian, very low (1.9%) total cortex with most showing less than 50% coverage, however the remaining four flakes (.7%) have 100% cortex coverage (Table 5.4). In a test for statistical significance Pearson's chi-square showed that there is a significant relationship at the 0.05 level between cortex and the three raw materials (χ^2 = 47.069, p. = 0.000). Because this information shows that cortex is a significant variable, but does not show which raw material has significantly different amounts of cortex, a Pearson's chi-square was also performed between the rhyolite and the quartz alone. Results show there is a significant difference at the 0.05 level between rhyolite and quartz when looking at cortex (χ^2 = 48.180, p. = 0.000). The frequency of obsidian does not allow for this test to be performed due to the expected frequency of cortex being less than five, in this case, fisher's exact test was performed. Results show there is no significant difference between rhyolite and obsidian for frequency of cortex (χ^2 = 2.189, p. = 0.139). Although the splitting of material types introduces some error, the findings are still expected to represent true results. Therefore, the comparison of cortex between the materials supports rhyolite as a nonlocal material.

Table 5.4 Cortex comparisons for rhyolite local/nonlocal classification

Raw Material	0% cortex coverage	<50% cortex coverage	>50% cortex coverage	100% cortex coverage
rhyolite	564 (98.1%)	7 (1.2%)	0 (0.0%)	4 (.7%)
quartz	772 (88.2%)	21 (2.4%)	19 (2.2%)	63 (7.2%)
obsidian	28 (93.3%)	2 (6.7%)	0 (0.0%)	0 (0.0%)

High frequencies of shatter for a raw material have been demonstrated to correlate with primary reduction of a material at a site. Primary reduction has also been shown to associate with local materials. At Mead these statements hold true; no shatter was found for obsidian artifacts while 4.9% of the quartz artifacts are classified as shatter. Because the expected value for shatter for rhyolite is less than five, Fisher's exact test was used to test significance between all materials. There is no significant difference between rhyolite and obsidian in frequencies of shatter (χ^2 = 0.187, p. = 0.665), however there is a significant difference for shatter between rhyolite and quartz (χ^2 = 21.886, p. = 0.000). Therefore, the frequency of shatter for rhyolite also seems to support its nonlocal nature.

The relative percentages of dorsal scar counts for raw materials can demonstrate a number of characteristics. Counts can be used to infer types of reduction, stage of reduction, etc. In this case, stage of reduction can be related to the locality of a raw material. Low dorsal scar counts are related to early stage reduction or primary reduction which has been demonstrated to be related to local materials. High counts of dorsal scars relates to late stage reduction and possible to nonlocal materials. At Mead, over half of all obsidian artifacts found has three or more dorsal scars. A total of 95.5% of all quartz artifacts have two or less dorsal scars. In comparison, rhyolite flakes with two or less dorsal scars total 82.6%. This would seem to support that rhyolite may be considered a locally obtained material however an ANOVA test with a post-hoc Tukey test for statistical significance shows that between all three materials dorsal scar counts are significantly different (F = 492.832, p = 0.000; F = 1236.960, p = 0.000: F = 242.344, p = 0.000). This means that rhyolite is significantly different from both local and nonlocal materials when looking at dorsal scar counts. Therefore rhyolite does not actually resemble a local or nonlocal source using this category.

Table 5.5 Dorsal scar count comparisons for rhyolite local/nonlocal classification

Raw Material	**Dorsal Scar Count**					
	0	**1**	**2**	**3**	**4**	**>4**
Rhyolite	4 (0.7%)	260 (45.2%)	211 (36.7%)	76 (13.2%)	18 (3.1%)	6 (1.0%)
Quartz	56 (6.7%)	450 (54.1%)	289 (34.7%)	36 (4.3%)	1 (0.1%)	0 (0.0%)
Obsidian	0 (0.0%)	4 (13.3%)	6 (20.0%)	10 (33.3%)	4 (13.3%)	6 (20.0%)

Size class can also inform on the locality of a raw material. A material with larger size classes represented is often linked to a more locally available material. This is true at Mead; obsidian flakes are between size classes 1-4, while quartz flakes are between size classes 1-25. Rhyolite is intermediary with size classes ranging from 1-8. Pearson’s chi square shows that there is a significant difference in size classes between rhyolite and quartz (χ^2 = 42.778, p = 0.000), but not between rhyolite and obsidian (χ^2 = 5.725, p = 0.572). This adds to the evidence that rhyolite is a nonlocal material

The percent of modified flakes found for a raw material can also inform on locality. Fisher’s exact test was performed on the frequency of modified and unmodified flakes between quartz and obsidian and results show a significant difference (χ^2 = 94.527, p = 0.000). Therefore, the percentage of modified flakes within raw materials is assumed to have relevance to determining between local and nonlocal materials. Using Fisher’s exact test, rhyolite is significantly different from obsidian when considering presence of modification (χ^2 = 81.942, p = 0.000) as well as percent modification per artifact (χ^2 = 97.495, p = 0.000). No significant difference was found between rhyolite and quartz (χ^2 = 0.364, p = 0.546) This suggests that rhyolite is more similar to quartz and may be local. However the mere frequency of modified flakes may not take into account important factors. Although there is only a single modified artifact made from rhyolite, it is a heavily curated long-axis scraper whereas all three quartz artifacts are lightly modified flakes. To account for this, percent utilization was tested in addition to presence or absence of modification. In sum, this category suggests that rhyolite may be found locally.

Table 5.6 Size class comparisons for rhyolite local/nonlocal classification

Size Class	Obsidian	Quartz	Rhyolite
SC1	2 (6.7%)	78 (8.9%)	93 (16.1%)
SC2	18 (60.0%)	434 (49.6%)	261 (45.2%)
SC3	8 (26.7%)	179 (20.5%)	126 (21.8%)
SC4	2 (6.7%)	67 (7.7%)	57 (9.9%)
SC5	0 (0.0%)	39 (4.5%)	21 (3.6%)
SC6	0 (0.0%)	27 (3.1%)	11 (1.9%)
SC7	0 (0.0%)	16 (1.8%)	8 (1.4%)
SC8	0 (0.0%)	7 (0.8%)	1 (0.2%)
SC9	0 (0.0%)	8 (0.9%)	0 (0.0%)
SC10-25	0 (0.0%)	20 (2.1%)	0 (0.0%)

Table 5.7 Modification frequency comparisons for rhyolite local/nonlocal classification

Raw Material	Modified	Unmodified
Obsidian	6 (16.7%)	30 (83.3%)
Rhyolite	1 (0.2%)	578 (99.8%)
Quartz	3 (0.3%)	875 (99.7%)

Other evidence to consider is the presence of cores. The presence of cores at a site has been linked with local materials (Andrefsky 1994, 2005; Binford and O'Connell 1984). Neither obsidian nor rhyolite have any cores found at the site, however there are a total of six quartz cores. This further suggests that rhyolite may not be a locally available material.

Differences between variables indicative of locality between rhyolite, obsidian, and quartz show that while rhyolite is somewhat intermediary. Dorsal scar count shows that rhyolite is in between local and nonlocal, modification percent shows that rhyolite may be considered local, while cortex, shatter and size class all show that rhyolite is most likely to be nonlocal. Considering the bulk of the evidence points towards rhyolite as being nonlocal, for the purpose of this project, rhyolite will hereafter be considered a nonlocal material. It is important to note that the designation of all materials at Mead except for quartz, brown quartzite and obsidian are purely postulations. Only the quartz and obsidian have known sources and locality of all other materials is a merely a best guess. Any reference made to a material's locality is an approximation until the source location is identified and distance from the site can be measured.

5.3 CZ1b Artifacts

A total of 3,982 stone artifacts were recovered from Cultural Zone 1b. Artifacts by category include two burin spalls, one burin, three flake cores, three microblades (two of which have edge damage), 38 modified flakes, one boulder spall scraper, and two other scrapers. In general, the tools assemblage for CZ1b does not exhibit intense curation or exhaustive reduction. Each tool class is discussed below.

Burin Spalls (n=2)

Both burin spalls found in CZ1b are made from grey chert (Figure 5.18). Both are categorized as secondary burin spalls. Specimen 105-216 measures 0.45 cm in width, 1.47 cm in length, 0.17 cm in thickness and 0.12 g in weight. Artifact 105-216 has evidence of light retouch on the right lateral edge on the dorsal face totaling 0.26 cm in length. The working edge angle is 40˚. Specimen 102-56 measures 0.5 cm in width, 1.58 cm in length, 0.22 cm in thickness and 0.24 g in weight.

Figure 5.18 CZ1b burin spalls

Flake Cores (n=3)

All three flake cores found in CZ1b are the brown quartzite material type. E17-99 is a multidirectional core with a total of six flake scars. The maximum flake scar dimension measures 9.33 cm in length by 9.47 cm in width. The maximum linear dimension of the core is 6.47 cm and it weighs 0.12 kg. This flake core shows evidence of thermal alteration through a deep reddening of the material. E17-106 is a multidirectional core with a total of five flake scars. Maximum scar dimension measures 4.94 cm in length by 4.33 cm in width. The maximum linear dimension of the core is 9.47 cm and it weighs 0.30 kg. E26-31 is a unidirectional core with a total of four flake scars. The maximum flake scar dimension measures 12.81 cm in length by 6.42 cm in width. The maximum linear dimension of the core is 12.92 cm and it weighs 0.24 kg.

Microblades (n=3)

All three microblades in this cultural zone have been classified as grey chert and are fragments (Figure 5.19). Two of the three microblades show evidence of edge damage. Specimen 103-181 measures 1.03 cm in length by 0.81 cm in width and by 0.11 cm in thickness and weighs 0.09 g. It a single arris and the right lateral edge shows evidence of light microchipping measuring 1.07 cm in length on the ventral face with an edge angle of 10˚. Specimen E46-28 measures 1.73 cm in length by 0.65 cm in width and by 0.14 cm in thickness and weighs 0.19 g. It has two arrises and the left lateral edge shows evidence of light retouch and chipping totaling 1.31 cm in length clustered on the dorsal face with an edge angle of 30˚. Specimen E46-20 measures 1.54 m in length by 0.54 cm in width and by 0.09 cm in thickness and weighs 0.08 g. It has two arrises and shows no evidence of edge damage.

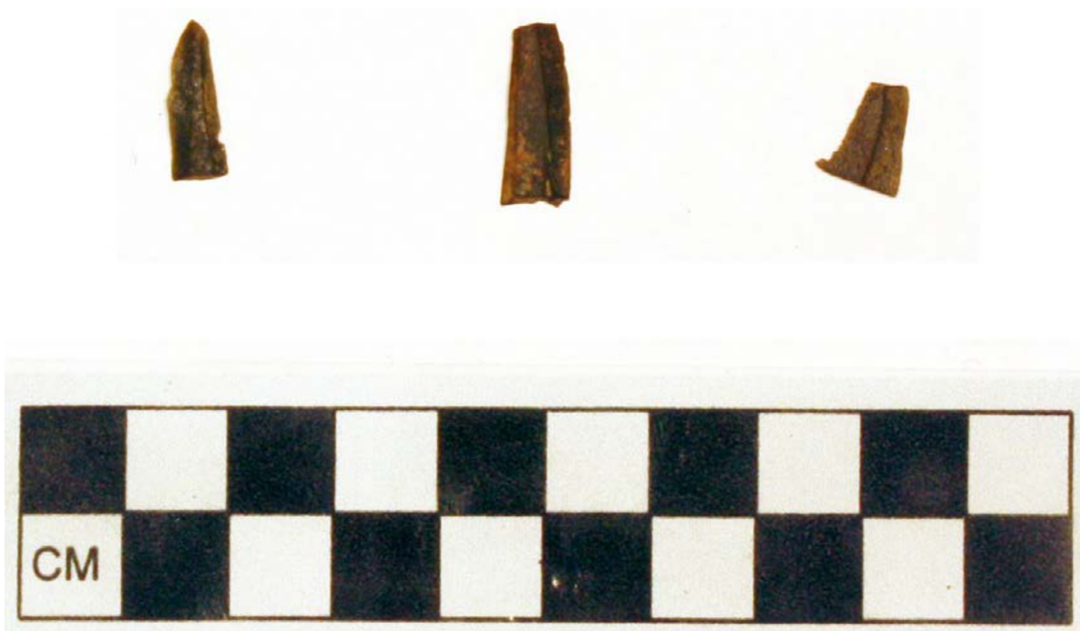

Figure 5.19 CZ1b microblades

Burin (n=1)

The single burin specimen for this cultural zone is comprised of a brown-grey chalcedony classed as grey chalcedony and a banded chalcedony (Figure 5.20). The grey chalcedony burin is a transverse burin measuring 3.06 cm in length, 1.63 cm in width, 0.42 cm in thickness and weighing 3.51 g. There is evidence if thermal alteration in a slight reddening of some of the material. There are a total of two burin scars of an indeterminate location. There is evidence crushing and burin wear on the dorsal and ventral faces of the perceived right lateral edge, and chipping on the ventral face of the perceived proximal end of the right edge. Modified edges measure 84˚ in working angle.

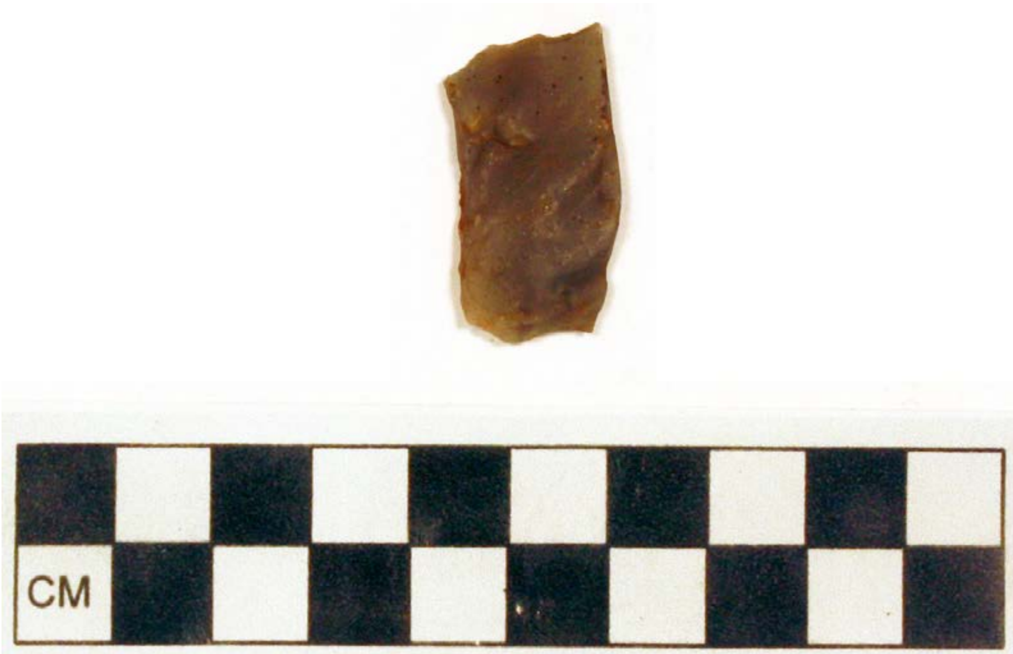

Figure 5.20 CZ1b burin

Modified Flakes (n=38)

This category includes both detached and objective pieces however flakes that could be more commonly categorized as scrapers have been separated out for the purpose of description. Six raw material types were present in modified flakes for CZ1b. Raw materials included obsidian (n=5, 12.2%), grey chert (n=30, 75.7%), one bluish grey chert (n=1, 2.4%), brown chert (n=1, 2.4%), black chert (n=1, 2.4%), and banded chalcedony (n=2, 4.9%). A total of four flakes have complex platforms (19.0%), one prepared (4.8%), 16 simple (76.2%). Four platforms are lipped. One grey chert flake shows evidence of thermal alteration in the form of a reddening of the material as well as potlidding. This flake is also the only modified flake in CZ1b to have cortex (less than 50%). Out of the 11 complete flakes, one flake (9.0%) has a single facet on the dorsal surface, two flakes have two facets (18.2%), four flakes have a count of three facets each (36.4%), two flakes have four facets (18.2%), and two flakes contain over four facets (18.2%). Only one modified piece was made on a blade blank, all others are categorized as simple flakes. Average mean weight of 1.9±4.64 cm (median=0.19 cm), mean width of 1.55±1.15 cm (median=1.05 cm), mean length of 1.76±1.51 cm (median=1.2 cm), mean thickness of 0.26±0.22 cm (median=0.21 cm). All means appear larger for modified flakes when compared to the means of unmodified flake measurements, but only width, length and weight are statistically significantly larger at the 0.05 level (width $t = 4.714$, $p = 0.000$; length $t = 5.068$, $p = 0.000$; thickness $t = 1.569$, $p = 0.117$; weight $t = 2.969$, $p = 0.003$).

Some specimens have markedly different edge damage characteristics depending on which edge was analyzed so a secondary class, modification unit, was added. A modification unit accounts for each worked edge on and every flake. A total of 43 modification units account for the modified flake assemblage. Modified flakes were predominately (n=33) altered by only one unit, with five specimens having two modified units. Five modifications units were categorized as heavy retouch, the remaining 38 units were classified as light. Modification type consisted mostly of retouch (n=36), with chipping the next most common (n=6), and only one unit showing evidence of microchipping. Modification position was generally evenly distributed between right lateral (n=12, 27.9%), left lateral (n=15, 34.9%) and distal (n=15, 34.9%) location. One unit was modified on the proximal edge (2.3%). Most units were modified only on the dorsal face of the specimen (n=23, 53.5%). There was also a high number of modified units located on only the ventral surface (n=15, 34.9%). Three (6.9%) units were found to be on the direct edge of a specimen and two (4.7%) flakes had one modification unit each with damage on both the ventral and dorsal faces. Edge shapes occurred as either concave (n=10, 21.7%), convex (n=3, 6.5%), or straight (n=33, 71.8%). Mean modification length for all units is 2.38 ± 5.61, with a mean for the sum of modification lengths per flake of 3.82 ± 9.5. The percentage of modified edges for each flake (total # modified edges/total edges) averages to 29.61%. The modified edge angle average is $30^{\circ} \pm 15^{\circ}$. Modified flakes generally comprise of small (n=31, 72.2%) and very small (n=1, 2.2%) flakes, with eight (18.6%) medium flakes and three (7.0%) large flakes.

Boulder Spall Scraper (n=1)

The grey basalt boulder spall scraper was found in situ in three separate pieces that accurately conjoin (Figure 5.21). The conjoined whole was analyzed as one tool. The boulder spall scraper measures 5.61 cm in length, 8.94 cm in width1.51 in thickness, and weighs 84.34g. The scraper has no discernible platform with evidence of a break along the proximal edge and the dorsal surface is 100% cortex in the form of a smoothed weathered river-cobble-like surface. These distal and partial lengths of the left and right laterals on the dorsal surface showed evidence of light retouch measuring 12.19 cm in length with and edge angle ranging from 24° to 39°.

Figure 5.21 CZ1b boulder spall scraper

Scrapers (n=2)

There are two unifacially-flaked scrapers found in CZ1b at Mead (Figure 5.22). One is a long-axis rhyolite scraper measuring 6.99 cm in length, 4.74 cm in width, 0.74 cm in thickness, and weighs 19.14 g. It has a simple platform with a salient bulb of force and over four dorsal scars. The modification is classified as heavy/intense retouch and is located on the dorsal face of the left lateral edge. The total modification length measures 8.57 cm with and edge angle of 46˚. The other unifacially-flaked scraper is both a long-axis and short axis scraper. It is made from the banded chalcedony at the site and appears dark grey to black in color. It measures 6.96 cm in length, 4.76 cm in width, 0.7 cm in thickness, and weighs 26.08 g. It has a complex platform with a salient bulb of force and visible eraillure scar. Modification is present on the left and right lateral margins as well as on the distal end. All modification has been classified as heavy retouch. The distal and left lateral margins have a straight edge shape with modification on the dorsal surface while the right lateral is convex and has modification on the ventral surface. Modification length totals 18.22 cm with edge angles ranging from 35˚ to 41˚.

Figure 5.22 CZ1b scrapers

Unmodified Flakes (n=3933)

Of the 1,307 flakes that have platforms 3.1% have eraillure scars. A total of 33.9% of flakes with platforms have lipped platforms. Of the 1,310 flakes that have discernible bulbs of force, 71.4% have diffuse bulbs, while 28.6% have salient bulbs. Platform types consist of complex (n=127, 9.8%), cortical (n=11, 0.8%), crushed (n=2, 0.2%), prepared (n=22, 1.6%) and simple (n=1145, 87.6%). Considering cortex, 99.1% of the total 3,933 flakes have no cortex, 0.5% has less than 50%cortex, 0.1% has more than 50%, and 0.3% have 100% cortex. The average weight for the debitage assemblage of CZ1b is 0.90 g. Other averages for metric measurements include 0.98 cm for width, 0.85 cm for length, and 0.19 cm for thickness. To total of 98 flakes have evidence of thermal alteration. The most common indication of this is reddening of the material, but it can also include potlidding, blackening of the materials, changes in luster and crazing.

Further flake analysis using MSRT size classes are partitioned by raw material type. Following Prentiss (2001) and Sullivan and Rozen (1985) the MSRT frequencies can be used to differentiate between core and tool reduction. In this case a core reduction is defined as the manufacture of flakes from "a mass of material…performed by the worker to the desired shape to allow for the removal of a definite type of flake or blade" (Crabtree 1972:30). Tool production is then defined as "other results of the lithic reduction/shaping process" including bifaces and modified flakes (Prentiss 2001:149).

Table 5.8 CZ1b flake totals by raw material type

Raw Material	N	%	Weight	%
andesite	1	0.0%	0.26	0.01%
jasper	3	0.1%	0.18	0.01%
quartz	3	0.1%	0.97	0.03%
obsidian	8	0.2%	1.12	0.03%
banded chalcedony	10	0.3%	0.68	0.02%
grey basalt	13	0.3%	3.33	0.09%
grey chalcedony	14	0.4%	1.67	0.05%
brown chert	16	0.4%	3.26	0.09%
black basalt	25	0.6%	3.07	0.09%
black chert	61	1.6%	6.66	0.19%
grey quartzite	266	6.8%	979.99	27.77%
brown quartzite	522	13.2%	2150.67	60.95%
rhyolite	572	14.5%	92.04	2.61%
grey chert	2419	61.5%	284.39	8.06%
Total	3933	100.0%	3528.42	100.00%

Table 5.9 CZ1b dorsal scar counts by raw material

Raw Material	Dorsal Scar Count					
	0	1	2	3	4	>4
Brown Quartzite	2 (2.7%)	37 (49.3%)	42 (32.0%)	11 (14.7%)	0 (0.0%)	1 (1.3%)
Rhyolite	0 (0.0%)	22 (42.3%)	18 (34.6%)	9 (17.3%)	1 (1.9%)	2 (3.8%)
Grey Chert	0 (0.0%)	89 (33.2%)	107 (39.9%)	58 (21.6%)	7 (2.6%)	7 (2.6%)
Grey Quartzite	0 (0.0%)	7 (31.8%)	7 (31.8%)	6 (27.3%)	2 (9.1%)	0 (0.0%)
Black Chert	0 (0.0%)	1 (7.1%)	8 (57.1%)	3 (21.4%)	1 (7.1%)	1 (7.1%)

Noticeably, flake fragments tend to dominate the brown quartzite assemblage, particularly in the medium, small and very small size classes (Table 5.10). According to Prentiss' model, two things may account for this: soft hammer reduction, or biface reduction. Biface reduction should produce small medium and large flakes with a high number of flake fragments, reduced number of broken flakes, and very low numbers of complete flakes. This hold true for the small size category but not for the medium and very small categories. Given that there are no modified flakes for brown quartzite and a very low percentage of complex platforms, it is not likely that biface reduction accounts for the distribution of typologies in these smaller size classes. It is more likely that the use of soft hammer reduction tool accounts for the high frequency of fragments. The high percentage of complete flakes in the large and very large categories indicates hard hammered large core reduction. The presence of large and medium split flakes also suggests this. Medium flake core reduction is also suggested by the high numbers of small fragments. These patterns indicate that core reduction, for the purpose of flake blank production, was the dominant lithic activity in CZ1b.

Table 5.10 MSRT summary for CZ1b brown quartzite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	19 (9.9%)	21 (10.9%)	151 (78.6%)	1 (.5%)	0 (0.0%)
Small	54 (25.8%)	23 (11.0%)	130 (62.2%)	2 (1.0%)	0 (0.0%)
Medium	21 (25.6%)	14 (17.1%)	40 (48.8%)	3 (3.7%)	4 (4.9%)
Large	6 (15.8%)	16 (42.1%)	11 (28.9%)	1 (2.6%)	4 (10.5%)
Very large	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

The suggestion of large and medium core reduction in brown quartzite is also supported by frequencies of cortex and dorsal scar counts, where 84% of all brown quartzite flakes have less than three dorsal scars (indicative of primary core reduction) and 2.3% of the assemblage has some cortex present. A total of 1.0% of brown quartzite flakes in CZ1b have less than 50% cortex on their dorsal surface. 0.2% of flakes have over 50% cortex coverage, and 1.1% has 100% cortex coverage on their dorsal surface. Additionally, of the 183 brown quartzite flakes with platforms 0.5% are complex, 2.2% are cortical and 97.3% are simple. The low frequency of complex platforms and higher count of cortical platforms is indicative of core reduction, which is consistent of all other data. The data suggests that in CZ1b, brown quartzite was being reduced as primary core reduction of large and medium sized cores with hard hammers. Once reduced, it is likely that more precise soft hammer production of medium sized flakes occurred.

One note should be clarified. For the brown quartzite material specifically, core reduction is expected to produce higher frequency of shatter than seen here. The low frequency of shatter is mostly likely due to cataloging error. Because the material occurs naturally at the site, brown quartzite pebbles are also found. If cultural association could not be confirmed through the presence of a ventral surface and other factors, it was most likely cataloged as a pebble rather than shatter.

For rhyolite, a high frequency of fragments in the small, very small and medium size categories once again may suggest soft hammer production (see Table 5.11). Additionally, the distribution of flakes between the other typologies is similar to the expected outcome for biface reduction.

Table 5.11 MSRT summary for CZ1b rhyolite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	54 (15.6%)	31 (9.0%)	259 (74.9%)	2 (.6%)	0 (0.0%)
Small	44 (21.5%)	16 (7.8%)	142 (69.2%)	0 (0.0%)	3 (1.5%)
Medium	7 (33.3%)	4 (19.0%)	9 (42.9%)	0 (0.0%)	1 (4.8%)

However, dorsal scar counts do not support biface reduction. While bifacial reduction is expected to produce an assemblage with the largest proportion of flakes having three or more dorsal scars, the rhyolite assemblage has only 23% fitting this description. Dorsal scar counts for rhyolite indicate that rhyolite was in stages of primary or secondary reduction, not tertiary/biface reduction. Although dorsal scar count has been used in a multitude of research as a way to classify between core and biface reduction, this assemblage may act differently. It has already been shown that dorsal scar counts are an unimportant factor when comparing quartz and obsidian at Mead. The treatment of these two materials is vastly different, and a statistically significant difference between dorsal scar counts was expected, but not found. This could be corrected if dorsal scar counts are controlled for by flake size

Other evidence suggests biface reduction may not have been the primary goal of rhyolite reduction. Of the 160 rhyolite flakes with platforms 6.9% are complex, 2.5% are cortical, and 90.6% are simple. Both cortical and complex platforms are present, however the high percentage of simple platforms suggests nonbifacial thinning. Cortex also informs on the reduction of rhyolite. A total of1.2% of rhyolite flakes have less than 50% cortex and 0.7% have 100% coverage. No flakes have over 50% cortex coverage, and the rest (98.1%) have no cortex. This would suggest that secondary reduction may be most likely for rhyolite reduction. The total evidence then suggests that rhyolite was being reduced with soft hammer tools. Medium or large sizes blanks or cores were primarily being nonbifacially thinned for the production of tools with little biface production occurring.

For grey chert, the high percentage of complete flakes in the large size category suggests hard hammer core reduction. The medium, small and very small size categories have similar distributions with a high percentage (over half) of flake fragments, with broken flakes being the next most prevalent and very few complete flakes. This matches expected outcomes for biface reduction. The small and very small categories also have some split flakes present and notable the small category has nearly 30% broken flakes. This suggests some pressure flaking could be occurring.

Table 5.12 MSRT summary for CZ1b grey chert

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	345 (20.1%)	175 (10.2%)	1169 (68.0%)	5 (0.3%)	25 (1.5%)
Small	194 (29.3%)	80 (12.1%)	384 (57.8%)	1 (0.2%)	4 (0.6%)
Medium	7 (19.4%)	9 (25.0%)	20 (55.6%)	0 (0.0%)	0 (0.0%)
Large	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)

Dorsal scar counts indicate that primary core reduction should have been occurring as well as some tool and biface production. Cortex frequencies support bifacial thinning with 0.2% of flakes having cortex. Of the 839 grey chert flakes with platforms 12.5% are complex, 0.1% are cortical, 0.2% are crushed, 2.4% are prepared, and 84.8% are simple. A higher number of complex platforms, although still small compared with simple platforms, also may suggest some biface reduction occurred. With all the evidence together grey chert in CZ1b most likely had some secondary and tertiary blank and biface reduction occurring with soft hammer tools.

For grey quartzite, MSRT distributions once again show a high frequency of fragments, 40% in the large size category, 68.2% in the medium size category, 81.1% in the small category, and 88% in the very small size category. The higher percentage of complete flakes in the large category suggests soft hammer core reduction. The high percentage of complete flakes than broken flakes in the medium category indicates medium size cores were being reduced again with a high probability of soft hammer percussion. The distribution of small and very small flakes with high or more even percentages of broken flakes compared with complete flakes, as well as the presence of shatter and split flakes and the consistently high number of flake fragments suggests soft hammer tool production from medium sized cores or blanks.

Table 5.13 MSRT summary for CZ1b grey quartzite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	5 (4.3%)	7 (6.0%)	103 (88.0%)	1 (0.9%)	1 (0.9%)
Small	12 (13.3%)	3 (3.3%)	73 (81.1%)	1 (1.1%)	1 (1.1%)
Medium	4 (9.1%)	7 (15.9%)	30 (68.2%)	2 (4.5%)	1 (2.3%)
Large	3 (20.0%)	5 (33.3%)	6 (40.0%)	1 (6.7%)	0 (0.0%)

With 63.6% of flakes having less than three flake scars, dorsal scar counts also suggest that both tool production and core reduction were occurring. A total of 0.8% of flakes have some cortex suggesting cores may not have been brought in as raw cobbles of material, but rather reduced cores. Additionally all 49 flakes with platforms present have single facet platforms. The evidence together suggests that medium and large cores or blanks were being reduced, and tools were then being produced from that using a soft hammer.

For black chert in CZ1b size classes include medium, small and very small. In the medium category, one flake fragment suggests soft hammer reduction. In the small size category, the broken flakes have the highest percentage indicating tool production. In the very small size category, the high percentage of flake fragments and the even distribution of broken and complete flakes suggest biface reduction.

Table 5.14 MSRT summary for CZ1b black chert

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	9 (20.5%)	10 (22.7%)	24 (54.5%)	1 (2.3%)	0 (0.0%)
Small	7 (43.8%)	4 (25.0%)	5 (31.3%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)

Because 64% of black chert complete flakes have less than 3 dorsal scars, it can be inferred that some core reduction occurred. No black chert flakes have any cortex suggesting cores may have been prepared or reduction occurred on prepared blanks. This is supported by evidence of prepared platforms in the black chert assemblage. Of the 29 black chert flakes that have platforms, 13.8% have complex platforms, 3.4% have prepared platforms, and 82.8% have simple platforms. The frequency of complex and prepared platforms suggest some bifacial reduction occurred alongside nonbifacial thinning. The evidence together indicates some soft hammer core reduction with tool production and biface reduction occurring later on in the reduction sequence.

5.4 CZ2 Artifacts

A total of 1,942 stone artifacts were recovered from Cultural Zone 2. Artifacts by category include one microblade with edge damage, three bifaces, three modified flakes, and 1,935 debitage flakes. In general, the tool assemblage for CZ2 does not exhibit intense curation or exhaustive reduction.

Microblades (n=1)

The single microblade found in CZ2 is made from grey chert. It measures 2.12 cm in length, 0.92 cm in width, 0.18 cm in thickness, and weighs 0.42 g. The specimen is a proximal fragment with a snap on the distal margin and one arris on the dorsal surface. The platform is simple with a salient bulb of force. Edge damage occurs on a continuous section measuring 0.53 cm in length on the distal portion of right lateral margin. The retouch has been classed as light modification with an edge angle of 12˚. The retouch occurs on the edge of the margin with no scars on either the dorsal or ventral face. There is evidence of trampling shown in a small pock mark on the dorsal surface as well as chipped and uneven margins.

Figure 5.23 CZ2 microblade

Bifaces (n=3)

The three bifaces found at the 2009 and 2011 Mead site excavations in the East Block were all found in CZ2 within 1 m^2 in Block 106. All specimens are made from a very dark grey chert with subtle light grey banding that has been grouped a grey chert raw material. Artifact 106-121 (Figure 5.24, right) has a bending fracture cause by raw material imperfection on the proximal margin however, the artifact was utilized after this break occurred and therefor has been termed a completely intact specimen. Clear evidence of retouch marks this biface as stage four, a utilized tool. Artifact 106-121 measures 6.46 cm in length, 2.77 cm in width, 0.77 cm in thickness, and weighs 15.14 g with a 28˚ edge angle. There is no hafting present and retouch continues all the way to base which may indicate that this biface was probably not used as projectile, more likely it functioned as a knife or scraper. For a utilized bifacial tool it is poorly formed, in profile view the edges are jagged and there are steep edge angles due to bad flaking at some areas along the edge. There is bimarginal clustered retouch on both the left and right laterals. This piece is not heavily reworked or utilized, the poor construction did not allow for much in the way of reshaping or sharpening.

Biface 106-258 (Figure 5.24, middle) is a proximal fragment measuring 3.68 cm in length, 2.77 cm in width, 0.83 cm in thickness, weighing 7.51 g with a 42˚ edge angle. A bending fracture occurring probably during sharpening. The modification is unimarginal retouch. The right margin has more invasive feathered flaking with microchipping and polish, while the left lateral has stepped and feathered retouch continuously and has a more glossy polish. The left lateral also has more acute edge angles while the right lateral has larger edge angles. Hafting occurred at as lanceolate type haft, this is indicated by a flaring out towards the distal end. Since retouch and utilization is present on the haft, this biface was probably hafted, used a projectile, broken and then utilized as a hand tool to a small degree.

Specimen 106-308 (Figure 5.24, left) is a distal fragment measuring 2.71 cm in length, 1.93 cm in width, 0.36 cm in thickness, weighing 2.16 g with a 34˚ edge angle. This is technically a utilized biface but is in a very early stage of production. Flake scars measure 0.55 cm on either surface, but no flake scars present across the whole face. Unimarginal retouch is only present on only one surface, both the left and right laterals have short amounts of feathered retouch (1.0 cm and 1.04 cm). No hafting occurred.

It should be noted that one other biface was found made from the same banded grey chert material during the 1990s excavations. This biface is similar to specimen 106-121 in that it was more likely used as a scraper rather than a projectile.

Figure 5.24 CZ2 bifaces

Modified flakes (n=3)

There are a total of three modified flakes, found in CZ1b. Specimen 104-147 is a broken grey chert flake with metric dimensions of 0.85 cm width, 1.76 cm length, 0.15 cm thickness, and 0.28 g in weight. Only the left lateral edge on the ventral surface was utilized showing evidence of microchipping for a continuous length of 0.85 cm. The modified edge is straight and has an edge angle of 25˚. 104-147 also has a single facet lipped platform. Artifact 104-185 is a grey chert flake fragment with metric dimensions of 3.77 cm in width, 1.36 cm in length, .48 cm in thickness, and 0.03 g in weight. Only the right lateral edge on the ventral surface was utilized showing evidence of light retouch for a continuous length of 1.59 cm. The modified edge is straight and has an edge angle of 38˚. The final specimen 104-235, is a grey chert flake fragment. Measurements are 0.75 cm in width, 0.29 cm in length, 0.14 cm in thickness, and 0.03 g in weight. Edge modification occurs only on the proximal edge, showing clustered light retouch for a total of 0.33 cm in length. The edge damage occurred along the ventral surface with and edge angle of 17˚. Due to the acute edge angle, and the occurrence of the damage along a broken edge of a small flake, this damage is most likely due to post depositional disturbance.

Unmodified flakes (n=1,935)

There are a total of 1,935 unmodified flakes in CZ2. Of the 732 flakes that have platforms 1.1% have eraillure scars. 52.9% of flakes with platforms have lipped platforms. Of the 733 flakes that have discernible bulbs of force, 72.3% have diffuse bulbs, while 27.7% have salient bulbs. Platform types consist of complex (n=78, 10.6%), cortical (n=1, .1%), and simple (n=653, 89.2%). Considering cortex, 99.8% of the total 1,935 flakes have no cortex, 0.1% has less than 50% coverage of their dorsal surface, 0.1% has 100% cortex coverage. The average weight for the debitage assemblage of CZ2 is 0.27 g. Other averages for metric measurements include 0.78 cm for width, 0.62 cm for length, and 0.11 cm for thickness. A total of 13 flakes have evidence of thermal alteration. The most common indication of this is reddening of the material, but it can also show as changes in luster.

Table 5.15 CZ2 dorsal scar counts by raw material

Raw Material	Dorsal Scar Count					
	0	1	2	3	4	>4
Brown Quartzite	0 (0.0%)	1 (10.0%)	6 (60.0%)	2 (20.0%)	1 (10.0%)	0 (0.0%)
Grey Chert	0 (0.0%)	136 (46.7%)	80 (27.5%)	46 (15.8%)	18 (6.2%)	11 (3.8%)

Table 5.16 CZ2 flake totals by raw material type

Raw Material	N	%	Weight (g)	%
jasper	1	0.1%	0.05	0.01%
obsidian	2	0.1%	0.09	0.02%
quartz	2	0.1%	0.12	0.02%
brown chert	3	0.2%	1.34	0.25%
grey chalcedony	5	0.3%	0.33	0.06%
rhyolite	5	0.3%	5.12	0.97%
black chert	7	0.4%	0.16	0.03%
grey quartzite	8	0.4%	35.24	6.69%
banded chalcedony	10	0.5%	0.26	0.05%
brown quartzite	44	2.3%	310.98	58.99%
grey chert	1847	95.5%	173.46	32.91%
Total	1934	100.0%	527.15	100.00%

MSRT distributions of brown quartzite in CZ2 have a high percentage of complete flakes in the very large and large size classes which indicate large core reduction. The high percentage of broken flake sin the medium category suggests tool production. In the small and very small categories the distribution of fragments and complete flakes indicates soft hammer tool reduction as well.

Table 5.17 MSRT percentage summary for CZ2 brown quartzite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	0 (0.0%)	2 (15.4%)	11 (84.6%)	0 (0.0%)	0 (0.0%)
Small	4 (19.0%)	5 (23.8%)	11 (52.4%)	0 (0.0%)	1 (4.8%)
Medium	3 (42.9%)	1 (14.3%)	3 (42.9%)	0 (0.0%)	0 (0.0%)
Large	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Very large	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

In total 70% of brown quartzite flakes have less than three flake scars which indicates core reduction. Additionally, 42 (95.5%) brown quartzite flakes have no cortex, one flake (2.3%) has less than 50% cortex, and one flake (2.3%) has complete coverage of its dorsal surface. This suggests that large original cobbles are not being reduced and supports the evidence for tool reduction. However of the 19 brown quartzite flakes that have platforms present one (5.3%) flake has a cortical platform, and 18 (94.7%) have simple platforms. This suggests primary reduction. The total evidence then indicates that some primary reduction of brown quartzite occurred with a focus shifting towards tool production as the reduction sequence continued.

For grey chert the single large fragment and the distribution of complete and fragmented flakes suggests medium core reduction with soft hammer. The very small and small size categories have similar distributions with more than half al the flakes categorized as fragments, with the next most abundant flake type as broken and complete flakes just under those percentages. Additionally a few shatter and split flakes are present in these size classes. This suggests soft hammer biface reduction.

Table 5.18 MSRT percentage summary for CZ2 grey chert

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	292 (20.5%)	198 (13.9%)	924 (64.9%)	3 (0.2%)	7 (0.5%)
Small	106 (27.5%)	80 (20.7%)	198 (51.3%)	0 (0.0%)	2 (0.5%)
Medium	5 (13.9%)	14 (38.9%)	17 (47.2%)	0 (0.0%)	0 (0.0%)
Large	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)

Dorsal scar counts for grey chert suggest that there was some core reduction occurring. Of the 1,847 grey chert flakes in CZ2, one flake (0.1%) has less than 50% cortex coverage. This contradicts evidence from dorsal scar counts and indicates the reduced cores may not be original cobbles. Of the 699 flakes that have platforms present 11.2% have complex platforms, and 88.8% have simple platforms. This suggests that there was some bifacial thinning occurring alongside nonbifacial thinning.

5.5 CZ3a Artifacts

A total of 13 grey chert flakes were found in CZ3a. Although the sample size from the 2009 and 2011 excavations is very small, the flakes merit a short description. Four flakes are complete, eight are fragments, and one is broken. Of five flakes with discernible platforms, three have simple platforms while two have complex and three platforms are lipped. No flakes have cortex. Total weight calculates to 3.07 g. Maximum dimensions range from 0.33 cm to 2.49 cm.

According to MSRT size classes five flakes classify as very small and eight classify as small. Not much can be determined about this component due to the extremely small sample size, however the limited data suggests that soft hammer intermediate and late stage biface production occurred. The frequency of complex and lipped platforms, dorsal scar count, fragments and presence of only small and very small flakes determines this.

5.6 CZ3b Artifacts

A total of 487 stone artifacts were recovered from Cultural Zone 3b. Artifacts by category include one microblade, two flake cores, 12 modified flakes, and 472 waste flakes. In general, the tool assemblage for CZ3b does not exhibit intense curation or exhaustive reduction except on banded and grey chalcedony.

Microblades (n=1)

The single microblade specimen in CZ3b is a medial section made from fine-grained grey basalt (Figure 5.25). Metric measurements are 0.99 cm in width, 1.77 cm in length, 0.27 cm in thickness, and 0.61 g in weight. The microblade has two arrises on its dorsal surface and is modified along the right lateral dorsal face. Modification is light chipping and found as clustered groups measuring 0.65 cm in total length with and edge angle of 47˚.

Figure 5.25 CZ3b microblade

Flake Cores (n=2)

Both flake cores found in CZ3b are made from the light grey quartz. 102-256 is a multidirectional core with a total of five flake scars. The maximum flake scar dimension measures, 6.32 cm in length and 8.8 cm in width. The maximum linear dimension of the core is 6.32 cm with a total weight of 0.18 kg. This flake core shows evidence of thermal alteration through a reddening of the material. E52-232 is a unidirectional core also made from quartz. This core has a total of four flake scars, with the largest flake scar measuring 9.97 cm in length and 5.11 cm in width. The maximum linear dimension of the core is 9.97 cm and it weighs 0.14 kg total.

Modified flakes (n=12)

Five raw material types were present in modified flakes for CZ3b. Raw materials included obsidian (n=1, 8.3%), grey chert (n=2, 16.7%), grey basalt (n=1, 8.3 %), grey chalcedony (n=3, 25.0%), and banded chalcedony (n=5, 41.7%). A single flake has a complex platform (12.5%), while seven have simple platforms (87.5%). Two platforms are lipped. No flakes exhibit any sings of thermal alteration or have any cortex evident. Out of the four complete flakes, two flakes have a count of three facets each (50.0%), one flake has four facets (25.0%), and one flakes contain over four facets (25.0%). Mean weight of the assemblage is 5.54 g, mean width is 2.37 cm, mean length is 2.73 cm, and mean thickness is 0.42 cm. All means of metric measurements larger in modified flakes than in unmodified flakes and all categories (width, length, thickness, and weight) are statistically significantly different at the 0.05 level. Modified flakes generally comprise of small (n=5, 41.7%), with four (33.3%) medium flakes and three (25.0%) large flakes.

While there are total of 12 modified flakes, there are 17 modification units for the CZ3b modified flake assemblage. Modified flakes were predominately (n=8) altered by only one unit, with three specimens having two modified units, and one having three modified units. Three modifications units were categorized as having heavy retouch, the remaining 14 units were classified as light. Modification type consisted mostly of retouch (n=15), with two artifacts having chipping. Modification positions included seven flakes with right lateral retouch (41.2%), nine flakes modified on the left lateral (52.9%) and one flake modified on the proximal edge (5.9%). Most units were modified only on the dorsal face of the specimen (n=13, 76.5%) with the rest on the ventral surface (n=4, 23.5%). Edge shapes occurred as either concave (n=5, 29.4%) or straight (n=12, 70.6%). Mean modification length for all units is 2.46 cm, with a mean for the sum of modification lengths per flake of 4.0 cm. The percentage of modified edges for each flake (total # modified edges/total edges) averages to 41.18%. The modified edge angle average is 38˚.

Unmodified flakes (n=472)

There are a total of 472 unmodified flakes in CZ3b. Of the 197 flakes that have platforms 0.5% have eraillure scars. 36.5% of flakes with platforms have lipped platforms. Of the 198 flakes that have discernible bulbs of force, 70.2% have diffuse bulbs, while 29.8% have salient bulbs. Platform types consist of complex (n=18, 9.1%), cortical (n=3, 1.5%), crushed (n=1, .5%), and simple (n=175, 88.9%). Considering cortex, 98.8% of the total 472 flakes have no cortex, 0.6% has less than 50% coverage of their dorsal surface, 0.4% has over 50% cortex coverage, and 0.2% has 100% cortex coverage. The average weight for the debitage assemblage of CZ3b is .77 g. Other averages for metric measurements include .91 cm for width, .82 cm for length, and 0.19 cm for thickness. A total of seven flakes have evidence of thermal alteration. The most common indication of this is reddening and blackening of the material, but it can also show as changes in luster.

Table 5.19 CZ3b flake totals by raw material type

Raw Material	N	%	Weight (g)	%
Brown Chert	1	0.2%	0.08	0.02%
Petrified Wood	1	0.2%	0.34	0.06%
Black Chert	3	0.6%	0.12	0.02%
Grey Quartzite	12	2.5%	84.10	16.02%
Brown Quartzite	14	3.0%	33.97	6.47%
Grey Basalt	25	5.3%	173.46	33.03%
Banded Chalcedony	42	8.9%	1.36	0.26%
Andesite	43	9.1%	95.14	18.12%
Grey Chalcedony	44	9.3%	4.11	0.78%
Quartz	107	22.7%	105.97	20.18%
Grey Chert	180	38.1%	26.44	5.04%
Total	472	100.0%	525.09	100.0%

Table 5.20 CZ3b dorsal scar counts by raw material

Raw Material	Dorsal Scar Count					
	0	**1**	**2**	**3**	**4**	**>4**
Andesite	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Banded Chalcedony	0 (0.0%)	0 (0.0%)	4 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Grey Chalcedony	0 (0.0%)	1 (16.7%)	3 (50.0%)	2 (33.3%)	0 (0.0%)	0 (0.0%)
Grey Chert	0 (0.0%)	11 (31.4%)	21 (60.0%)	2 (5.7%)	1 (2.9%)	0 (0.0%)
Quartz	0 (0.0%)	5 (41.7%)	4 (33.3%)	3 (25.0%)	0 (0.0%)	0 (0.0%)

MSRT distributions for andesite include large, medium, small and very small flake size classes. Large and medium sizes both have higher percentages of broken flakes which may indicate tool production. Both the small and very small categories have a higher percentage of fragments, with broken flakes being the next most common and very few shatter and split flakes. This distribution indicates biface reduction.

Table 5.21 MSRT percentage summary for CZ3b andesite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	4 (22.2%)	0 (0.0%)	11 (61.1%)	3 (16.7%)	0 (0.0%)
Small	4 (21.1%)	0 (0.0%)	14 (73.7%)	0 (0.0%)	1 (5.3%)
Medium	3 (75.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
Large	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Of the 43 total andesite flakes, 41 (95.3%) have no cortex, and two (4.7%) flakes have less than 50% cortex, which suggest secondary or tertiary reduction. Of the 14 flakes that have platforms, three (21.4%) are cortical, while 11 (78.6%) are simple, which suggests mostly secondary reduction occurred. Looking at the evidence together, the data indicates that large to medium size blanks of andesite were reduced for the production of tools with some bifacial reduction occurring as the objective piece was reduced.

For banded chalcedony the higher percentage of broken flakes in the small size class and the higher frequency of fragments with some broken flakes and few complete flakes suggests tool production and biface reduction.

Table 5.22 MSRT percentage summary for CZ3b banded chalcedony

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	15 (39.5%)	3 (7.9%)	20 (52.6%)	0 (0.0%)	0 (0.0%)
Small	2 (50.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)

The absence of cortex indicates tertiary reduction of banded chalcedony. Of the 21 complete banded chalcedony flakes, six (28.6%) are complex and 15 (71.4%) are simple. The comparatively high percentage of complex platforms to other raw materials in CZ3b suggests that bifacial thinning may have been occurring alongside nonbifacial reduction. All together it is likely banded chalcedony was both being reduced and shaped into tool forms as well as being sharpened after use.

For grey chalcedony the distribution of flakes in the small and very small categories also suggest bifacial reduction. The small category has a higher percentage of fragments with and even distribution of complete and broken flakes, while the very small category has the typical distribution of high fragments, some broken flakes and a few complete flakes.

Table 5.23 MSRT percentage summary for CZ3b grey chalcedony

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	12 (32.4%)	4 (10.8%)	20 (54.1%)	0 (0.0%)	1 (2.7%)
Small	2 (28.6%)	2 (28.6%)	3 (42.9%)	0 (0.0%)	0 (0.0%)

A total of 83.3% of complete flakes have three or more dorsal scars indicating bifacial reduction. No cortex present on any flakes indicating tertiary reduction, and of the 21 complete flakes, two (9.5%) are complex, one (4.8%) is crushed, and 18 (85.7%) are simple suggesting some nonbifacial reduction occurred. Together the evidence indicates that bifacial reduction and sharpening occurred on grey chalcedony.

For grey chert the medium flake category has a higher percentage of complete flakes indicating medium size core reduction. The small and very small categories have a typical distribution for this site with a high percentage of fragments, some broken flakes and a few complete flakes. This indicated bifacial reduction.

Table 5.24 MSRT percentage summary for CZ3b grey chert

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	38 (27.5%)	28 (20.3%)	71 (51.4%)	1 (0.7%)	0 (0.0%)
Small	13 (32.4%)	5 (13.2%)	20 (52.6%)	0 (0.0%)	0 (0.0%)
Medium	1 (25.0%)	2 (50.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)

Dorsal scar counts indicate core reduction however, as previously mentioned, dorsal scars probably do not significantly inform on reduction strategy unless corrected for size. A single flake (0.6%) has more than 50% cortex coverage, and all others (n=179, 99.4%) have no cortex present indicating secondary and tertiary reduction. Of the 87 complete flakes, eight (9.2%) are complex, and 79 (90.8%) are simple which suggests nonbifacial reduction. All together the evidence does not support one reduction strategy more than another. Secondary reduction seems most likely therefor it can be inferred that some tool and biface reduction occurred.

For quartz, natural cobbles are found on site therefore evidence is expected to suggest primary reduction. The almost even distribution of complete flakes, fragments, and shatter in the medium size category matches with the expected patterns for primary reduction on medium size cores. The small and very small categories match patterns expected for soft hammer tool production with very high frequencies of fragments and broken flakes.

Table 5.25 MSRT percentage summary for CZ3b quartz

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	9 (12.3%)	6 (8.2%)	56 (76.7%)	1 (1.4%)	1 (1.4%)
Small	9 (34.6%)	3 (11.5%)	14 (53.8%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	0 (0.0%)

Of the 12 complete flakes of quartz 75.0% have less than three dorsal scars which is consistent with core reduction. Of the 107 quartz flakes, one flake each (0.9%) has less than 50%, more than 50% and 100% cortex coverage suggesting some primary and secondary reduction. The remaining 104 (97.2%) flakes have no cortex. Of the 31 complete flakes, two (6.5%) are complex, and 29 (93.5%) are simple indicating nonbifacial reduction. All together the data suggest primary core reduction to secondary soft hammer tool reduction.

It should be noted, that while quartz is found on site, the signatures of the CZ3b quartz assemblage seem to differ from the signatures of the CZ4 quartz assemblage. In CZ3b cores are smaller, flakes sizes are smaller, there is less cortex and some complex platforms. This may indicate that the original cobbles were no longer readily available to the inhabitants in CZ3b like they were to those people who occupied the site in CZ4 or that a reliance on raw material has shifted to another.

5.7 CZ4 Artifacts

There are a total of 940 stone artifacts for CZ4. Tools by category include four flake cores, 11 modified flakes, 923 unmodified flakes, two burins, and one unifacial scraper. The unifacial scraper was used as a burin after discard and while it counts as a single artifact, it is classified as two different formal tool types and will be included under both categories.

Flake cores (n=4)

All flake cores in CZ4 are made from the quartz found on site in the grey bedded sands just below the sediment of CZ4. Specimen 102-243 is a multidirectional core with a total of 10 flake scars. The largest flake scar measures 7.44 cm in length and 9.51 cm in width. The maximum linear dimension of the core is 12.88 cm with a total weight of 0.82 kg. This core shows evidence of thermal alteration through a reddening of the material. Specimen E52-69 is a multidirectional core with a total of four flake scars. The largest flake scar measures 10.53 cm in length and 7.07 cm in width. The maximum linear dimension of the core is 11.54 cm with a total weight of 0.48 kg. This core has a size value of 5.54. Specimen E52-110 is a bidirectional core with a total of four flake scars. The largest flake scar measures 10.80 cm in length and 3.61 cm in width. The maximum linear dimension of the core is 11.66 cm with a total weight of 0.18 kg. This core has a size value of 2.10. Specimen E52-172 is a multidirectional core with a total of 5 flake scars. The largest flake scar measures 8.74 cm in length and 4.04 cm in width. The maximum linear dimension of the core is 9.98 cm with a total weight of 0.22 kg. This core has a size value of 2.20. Cores for CZ4 average a size value of 5.10 and cores for CZ3b average a size value of 1.49 however these are not statistically significantly different ($t = -1.208$, $p = 0.294$).

Burin on Snaps (n=2)

The two burins found in this component are made from grey chalcedony (Figure 5.26, right), and black chert (Figure 5.26, left). The black chert specimen, E40-92, is a burin-on-snap measuring 2.89 cm in length, 1.75 cm in width, 0.64 cm in thickness, and 4.36 g in weight. There is a burinated facet located on the left lateral edge of the burin. There is evidence of chipping, retouch and burin wear, on multiple edges and both the ventral and dorsal surfaces. The modified edge angle measures 77˚. The second burin, 101-263, is made from a heavily curated broken unifacial scraper made from grey chalcedony. It is classified as a burin-on-snap type. Metric measurements are as follows: 1.19 cm in length, 2.33 cm in width, 0.57 cm in thickness, and 2.26 g in weight. Modification is on the distal edge on the ventral face and consists of burin wear and chipping. The edge angle of the margin utilized as a burin is 75˚.

Figure 5.26 CZ4 burins

Scrapers (n=1)

Specimen 101-263 is a medial segment of a heavily worked unifacial scraper (Figure 5.26, right). It is made from grey chalcedony and was utilized as a burin after it was broken. In cross section this artifact is planoconvex. Measurements for this scraper are 1.19 cm in length, 2.33 cm in width, 0.57 cm in thickness, and 2.26 g in weight. Edge wear consists of heavy retouch on both the right and left lateral margins on the dorsal surface. The modified edges are straight in shape. The total modification length for this artifact is 2.07 cm with edge angles ranging from 48˚ to 44˚.

Modified flakes (n=11)

Four raw material types were present in modified flakes for CZ4. Raw materials included quartz (n=3, 27.3%), grey chalcedony (n=6, 54.5%), black chert (n=1, 9.1 %), banded chalcedony (n=1, 9.1%). A single flake has a cortical platform (20.0%), while four have simple platforms (80.0%). No platforms are lipped. No flakes exhibit any signs of thermal alteration and two flakes have less than 50% cortex on the dorsal surface. Both of these flakes are quartz and the cortex is the ventifacted surface. Out of the 2 complete flakes, one flake has a count of two facets (50.0%), and one flake has four facets (50.0%). Average mean weight of the assemblage is 4.07 g, mean width is 1.59 cm, mean length is 2.37 cm, and mean thickness is 0.48 cm. All means of metric measurements are larger in modified flakes than in unmodified flakes but only the length category is statistically significantly different at the 0.05 level (width $t = 1.760$, $p = 0.079$; length $t = 5.413$, $p = 0.000$; thickness $t = 1.257$, $p = 0.209$; weight $t = 0.640$, $p = 0.523$). Modified flakes generally comprise of small (n=6, 54.5%), with four (36.4%) medium flakes and one (9.1%) large flake.

While there are total of 11 modified flakes, there are a total of 12 modification units for the CZ3b modified flake assemblage. Modified flakes were predominately (n=10) altered by only one unit, with one specimen having two modified units. Two modifications units were categorized as having heavy retouch, the remaining 11 units were classified as light. Modification type consisted mostly of retouch (n=10), with one artifact having chipping and one artifact having both chipping and retouch. Modification positions included 4 flakes with right lateral retouch (33.3%), six flakes modified on the left lateral (50.0%) and two flakes modified on the distal edge (16.7%). Most units were modified only on the dorsal face of the specimen (n=9, 75.0%) with the some on the ventral surface (n=2, 16.7%) and one specimen (8.3%) containing edge modification on both surfaces (retouch on the dorsal surface, but chipping on the ventral surface). Edge shapes occurred as either convex (n=1, 8.3%) or straight (n=11, 91.7%). Mean modification length for all units is 2.04 cm, with a mean for the sum of modification lengths per flake of 2.72 cm. The percentage of modified edges for each flake (total # modified edges/total edges) averages to 29.17%. The modified edge angle average is 45˚.

Unmodified flakes (n=923)

There are a total of 923 unmodified flakes in CZ4. Of the 240 flakes that have platforms 1.7% have eraillure scars. 19.6% of flakes with platforms have lipped platforms. Of the 241 flakes that have discernible bulbs of force, 71.4% have diffuse bulbs, while 28.6% have salient bulbs. Platform types consist of complex (n=6, 2.5%), cortical (n=25, 10.4%), and simple (n=209, 87.1%). Considering cortex, 89.3% of the total 923 flakes have no cortex, 2.2% have less than 50% coverage of their dorsal surface, 2.0% has over 50% cortex coverage, and 6.6% has

100% cortex coverage. The average weight for the debitage assemblage of CZ4 is 1.54 g. Other averages for metric measurements include 1.07 cm for width, 0.92 cm for length, and 0.31 cm for thickness. A total of 38 flakes have evidence of thermal alteration. The most common indication of this is reddening of the material, as well as pot lidding.

Table 5.26 CZ4 flake totals by raw material type

Raw Material	N	%	Weight (g)	%
brown chert	1	0.10%	0.07	0.00%
jasper	1	0.10%	0.05	0.00%
banded chalcedony	5	0.50%	0.14	0.01%
grey basalt	7	0.80%	7.89	0.55%
red/grey siltstone	8	0.90%	0.6	0.04%
obsidian	17	1.80%	0.6	0.04%
andesite	38	4.10%	7.67	0.54%
grey chalcedony	41	4.40%	2.71	0.19%
grey chert	44	4.80%	22.08	1.55%
quartz	761	82.40%	1383	97.07%
Total	923	100.00%	1424.81	100.00%

Table 5.27 CZ4 dorsal scar counts by raw material

Raw Material	Dorsal Scar Count					
	0	**1**	**2**	**3**	**4**	**>4**
Andesite	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Grey Chalcedony	0 (0.0%)	2 (11.1%)	6 (33.3%)	6 (33.3%)	2 (11.1%)	2 (11.1%)
Grey Chert	0 (0.0%)	1 (12.5%)	2 (25.0%)	3 (37.5%)	1 (12.5%)	1 (12.5%)
Quartz	4 (5.3%)	32 (42.7%)	32 (42.7%)	7 (9.3%)	0 (0.0%)	0 (0.0%)

MSRT distribution for andesite in CZ includes the size categories of small and very small. For both categories, a high percentage of fragments and broken flakes may indicate soft hammer tool production.

Table 5.28 MSRT percentage summary for CZ4 andesite

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	7 (30.4%)	1 (4.3%)	14 (60.9%)	1 (4.3%)	0 (0.0%)
Small	3 (20.0%)	0 (0.0%)	12 (80.0%)	0 (0.0%)	0 (0.0%)

The single complete andesite flake has 2 dorsal scars and out of the 38 andesite flake no cortex is found. All 11 andesite flakes that have platforms are single faceted. This is consistent with MSRT data and together suggests andesite tools were being made with soft hammer percussion.

For grey chalcedony the small category has an equal distribution of broken and fragmented flakes while the very small size class is dominated by complete flakes. This indicates tool production.

Table 5.29 MSRT percentage summary for CZ4 grey chalcedony

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	4 (12.1%)	16 (48.5%)	13 (39.4%)	0 (0.0%)	0 (0.0%)
Small	3 (37.5%)	2 (25.0%)	3 (37.5%)	0 (0.0%)	0 (0.0%)

Over half of the complete grey chalcedony flakes have three or more dorsal flake scars indicating bifacial reduction occurred. Just over half of the complete flakes have three or more dorsal scars suggesting some bifacial reduction occurred. No grey chalcedony flakes have cortex which is suggestive of tertiary reduction. Of the 25 grey chalcedony flakes that have platforms, three (12.0%) have complex platforms, and 22 (88.0%) have simple platforms. All together it is likely that grey chalcedony tools were being sharpened in CZ4.

For grey chert, medium, small and very small size categories are present. The medium category with a single complete flake suggests medium sized core reduction. The small category with and even distribution of fragmented and broken flakes, suggests tool production. The very small size class has a higher frequency of fragmented flake with broken flake the next most common and a few complete flakes. This indicates biface reduction.

Table 5.30 MSRT percentage summary for CZ4 grey chert

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	10 (30.3%)	5 (15.2%)	18 (54.5%)	0 (0.0%)	0 (0.0%)
Small	4 (40.0%)	2 (20.0%)	4 (40.0%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	1 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Dorsal scar counts show that 62.5% of complete flakes have three or more dorsal scars showing that bifacial reduction occurred. This is supported by the absence of cortex. Of the 22 grey chert flakes that have platforms, three (13.6%) have complex platforms, while 19 (86.4%) have simple platforms. This suggests that nonbifacial reduction occurred. All together the evidence suggests that chert blanks were brought to the site, reduced to tools, some bifacial, and sharpened.

Quartz cobbles are found on site and MSRT and other lines of evidence support the expected pattern of large cobble primary reduction. The frequency of complete flakes as well as shatter for the large and very large size classes suggests large core reduction. In the medium size category, a high frequency of fragments with broken flake being the next most abundant and a few complete flakes as well as shatter and a split flake suggest medium core reduction and/or tool production. The small and very small size classes have similar signatures with high frequency of fragments with broken flake being the next most abundant and a few complete flakes as well as shatter and a split flake suggest tool production and medium flake production.

Table 5.31 MSRT percentage summary for CZ4 quartz

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	31 (7.1%)	42 (9.6%)	348 (79.5%)	17 (3.9%)	0 (0.0%)
Small	40 (16.1%)	18 (7.3%)	172 (69.4%)	17 (6.9%)	1 (0.4%)
Medium	17 (26.6%)	13 (20.3%)	29 (45.3%)	4 (6.3%)	1 (1.6%)
Large	3 (30.0%)	1 (10.0%)	5 (50.0%)	1 (10.0%)	0 (0.0%)
Very large	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

More than 90% of the complete quartz flakes have dorsal scars less than three further indicating core reduction for the quartz material. Of the 759 quartz flakes, 660 (87.0%) have no cortex, 20 (2.6%) have less than 50% cortex coverage, 18 (2.4%) have more than 50% cortex, and

61 (8.0%) have 100% cortex coverage on their dorsal surface. The high percentage of more than 50% cortex coverage is consistent with primary core reduction. Of the 168 quartz flakes that have platforms, 25 (14.9%) flakes have cortical platforms and 143 (85.1%) flakes have simple platforms. This again is consistent with primary core reduction. Additionally 36 flakes (4.7%) have been thermally altered primarily showing as a deep reddish color, suggesting some heat treatment or cobbles may have been attempted. Results indicate, as expected, that quartz primarily reduced at the site and used for tool production.

5.8 Comparisons by Cultural Zone

There are clear differences in the treatment of raw materials between the cultural components at Mead. A first approximation of CZ comparison was calculated using the Shannon Weaver Diversity Index and the Simpsons Index of Evenness. Both indices have been successfully applied to archaeological research and shown to be useful in comparing analytical units (Bever 2000; Potter 2005; Surovell 2003). The diversity and evenness indices for raw material types in each component (see Table 5.32) show that CZ1b has higher diversity of raw materials with medium evenness across the site. CZ2 has low diversity of raw materials. CZ3a, as expected, has no diversity of material types and is uneven because only one material type is found in this component. CZ3b has high diversity of material and is very even. CZ4 has medium diversity and is somewhat uneven. The results indicate that the most even spread of raw materials with highest diversity in tool types occur in CZs 3b and 1b. The diversity and evenness indices for formal tool types in each cultural component (see

Table 5.33) show that CZ1b has a high diversity of tool types. CZ4 has a medium diversity, while CZ2 has a low diversity in tool types found. Both CZs 3a and 3b have no diversity in formal tool types. The high diversity of raw material types and formal tool types found in CZ1b indicate that it may have been a long term occupation, at least longer than the other cultural occupations at the site. The high diversity of material types in CZ3b may also suggest a longer occupation length for CZ3b however contradicting the assumption for long term occupation is the absence of any diversity in formal tool types. This is likely due to sampling error, the addition of the 2012 data may reveal a higher diversity of formal tool types in CZ3b that was not found in 2009 or 2011.

Table 5.32 Diversity and evenness indexes for raw material

CZ	Number of Lithics	Number of Raw Material Types	Shannon-Weaver Diversity Index (H')	Simpson Index of Evenness(1-D)
1b	3933	15	1.2351	0.5792
2	1934	11	0.2593	0.0874
3a	13	1	0.0000	0.0000
3b	472	11	1.7704	0.7755
4	923	10	0.7687	0.3141

Table 5.33 Diversity and evenness indexes for tool classes

CZ	Number of Formal Tools	Tool Classes	Shannon-Weaver Diversity Index (H')	Simpson Index of Evenness(1-D)
1b	6	4	1.3297	0.8667
2	4	2	0.3466	0.5000
3a	0	0	0.0000	1.0000
3b	1	1	0.0000	1.0000
4	3	2	0.6365	0.6667

Differences in these indices show that there is variation between each component, but they do not look specifically at how materials were being used in each cultural occupation. By tracking the frequency of modified flakes and debitage for prevalent raw materials in each cultural component (Figure 5.27) specific changes in raw material use can be elucidated.

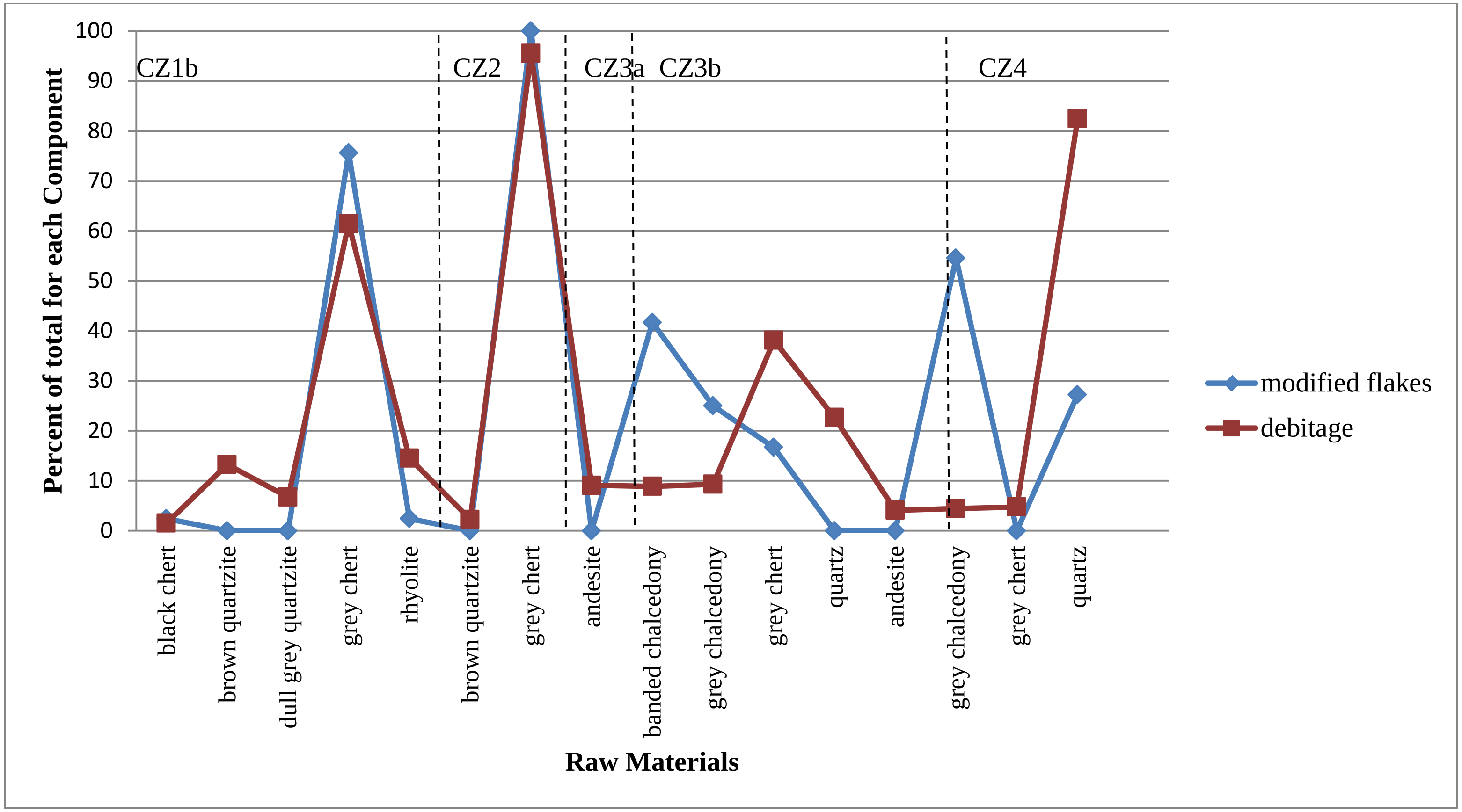

Figure 5.27 Percent debitage and modified debitage by raw material and CZ

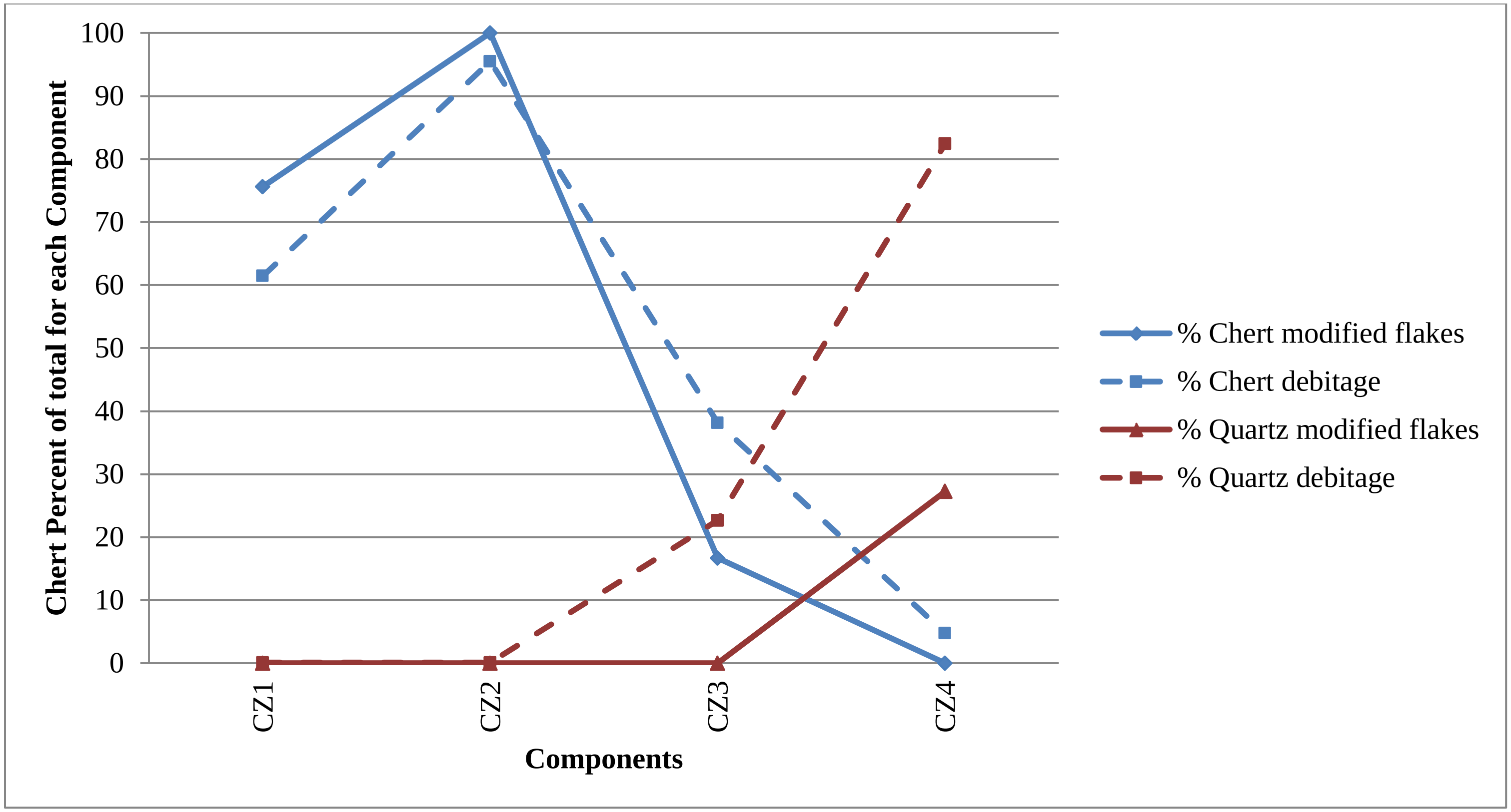

Figure 5.28 Grey chert and quartz use for each CZ

A clear contrast between the use of chert, the chalcedonies and the use of quartz at the site becomes evident when looking at Figure 5.28. In CZ4 and CZ3b, modified flakes are predominately made from grey or banded chalcedony. However after CZ3a, grey chert becomes the preference for modified flakes. This could be due to a change in procurement strategy. The CZ3b and CZ4 chalcedony modified flakes have a much higher average edge angle at 36˚ while the CZ1b chalcedony modified flakes have an average of 17˚ edge angles, although this is not statistically significantly different ($t = -1.223$, $p = 0.242$). The steeper edge angles and higher percent of utilized margins per modified flake in the lower component chalcedonies indicate that the chalcedony material was being maximized and curated to a greater, though not significant, extent than the chalcedony modified flakes in CZ1b, CZ2 and CZ3a. This suggests that more effort was taken to conserve the chalcedony materials in CZ3b and CZ4. Compare this to chert, where there is a higher occurrence of maximization in the lower components with an average of 42% utilization of each modified flake, though this is not statistically different from an average of 28% utilized margins in the upper components it still suggests a difference in treatment of grey chert. For edge angle of grey chert modified flakes, there is a difference between the average edge angle of 43˚ in the lower components and 30.98˚ in the upper components although this is not statistically significantly different ($t = -0.875$, $p = 0.388$). This shows that curation of maximization of materials was a priority in CZ3b and CZ4 and was practiced to a lesser, but not significant degree in the upper cultural zones. This could be due to a shift in mobility or resource availability. Highly mobile groups are expected to conserve raw materials to a greater extent due to unavailability of materials as they travel. However, as mobility decreases raw materials can be cached at sites, this abundance of toolstone leads to a more expedient reduction strategy where tools are discarded quickly after use resulting in slight edge angles and less maximization of each flake of material (Andrefsky 1994; Bamforth 1986).

A shift in the treatment of quartz is also apparent between the Cultural Zones. CZ4 shows a heavy reliance on quartz through the high frequency of quartz debitage. However after CZ4, a gradual shift towards a reliance on chert occurs. This can be seen in Figure 5.28. The inverse relationship between the grey chert and quartz assemblage representation suggests the on-site quartz material was replaced with the local grey chert. This could be due to preference for higher quality materials, but could also be due to the sediment build up between CZ4 and CZ3b. By the time of occupation in CZ3b, most of the original ventifacted quartz cobbles were buried in the grey bedded sands beneath about 20-35 cm of sediment. The data indicates that the occupants of

CZ3b did not reduce any original cobbles of the quartz but instead may have been reducing discarded cores from CZ4. This could be confirmed through a refitting analysis but is suggested by a statistically significant difference in the frequency of cortex between CZ3b and CZ4 quartz artifacts ($\chi^2 = 9.809$, $p = 0.020$). The decrease in availability of quartz in CZ3b is also likely a factor in the rise of the use of chert. It can be assumed that the grey chert source, even if local, is located farther away than the quartz which is found on-site. The low frequency of grey chert flakes in CZ4 could be because the occupants had quartz readily available and the chart required some time to procure. In CZ3b, when the quartz was buried it is likely that the occupants began utilizing the chert as the next most readily available toolstone source. However, the brown quartzite material is also found on-site. Although this material would have been easily accessible, it is possible the occupants were seeking higher quality materials and that the energy spent on gathering the chert did not out-weight the gain in material quality.

Chapter 6 Spatial Organization of Activities

6.1 Introduction

Spatial analysis can be a key method in understanding organization within a site (Binford 1977b:9; Clarke 1977; Hodder and Orton 1976; Kintigh and Ammerman 1982). Previous research at Mead conducted by Gilbert (2011) has shown that the upper cultural zones have likely been affected by cryoturbation and bioturbation resulting in a displacement and mixing of materials. However CZ3b and CZ4 reflect their original deposition suggesting that any results from spatial analysis would reflect human activities (Binford and Binford 1966). Although mixing has occurred in CZ1b and CZ2, a spatial analysis will still be conducted on these occupations, however results will take into account that patterns may be due to taphonomic disturbances rather than the decision-making behavior of past occupants. For this thesis, the goal of spatial analysis is to identify patterns in lithic organization by identifying lithic activity areas. This approach of defining activity areas and variants of it have been practically applied towards the Dry Creek and Gerstle River sites (Hoffecker 1983; Potter 2005). To achieve this, analytical units are identified as area, subareas, and clusters, analyzed individually, and compared with other lithic clusters and features. Areas may include multiple subareas, subareas include multiple clusters and are defined by densities of over 8 flakes per 25 square centimeters, and clusters are defined by groupings of raw material types within a subarea. Subarea boundaries are defined by point cloud on densities of 8 flakes per 25 cm^2 or higher. Where a subarea boundary includes only a portion of a 25 cm^2 quad, 3-pointed artifacts were examined closely and only those within a boundary were included. For screened artifacts, flakes were examined for associated raw material type and separated or included from there. Clusters are concentration of flakes within a subarea or area that total 5 or more flakes of the same raw material. Clusters totaling less than 30 flakes are analyzed for general flake characteristics i.e. Attribute Analysis, aiming at understanding reduction stage and strategy. Clusters totaling 30 flakes or more are analyzed in the same manner with the addition of MSRT.

Patterns can be identified by analyzing lithic clusters and comparing groupings of lithics. Variability might be due to multiple causes. Some variability among lithic clusters may reflect differences in lithic reduction. Variability could also be the result of similar activity sets occurring over time. If this is the case, tool types in the assemblage are expected to be more similar. Variability could also be the result of differences in activities occurring at the site. If the latter were the case, tool types present should be diverse. Also included in this spatial analysis is an examination of lithic relationships to hearth features. The numerous hearth features at Mead should represent areas around which activities occurred. By examining lithic activity areas, flaking events, and their relationship to each other and hearth features, pattern can be identified with each component, however little is known about how the late Pleistocene/early Holocene people organized themselves therefore, any interpretation beyond pattern recognition is offered as speculative.

6.2 Radiocarbon Dating and Wood Identification

In 2011 a total of four new dates were obtained. All samples were first analyzed for wood identification by Dr. Owen K. Davis and then sent to Beta Analytic Labs for radiocarbon dating. All samples underwent standard pretreatment for AMS dating. Sample 2011-4 was unburnt birch bark collected from the bottom perimeter of the cache pit feature in CZ1b. Sample 2011-5 was obtained from a hearth feature in Block 102. The sample was well-preserved charcoal (birch). The sample was dated to 11,770 cal BP to 12,080 cal BP placing it within CZ3b. Sample 2011-9 was a charcoal fragment recovered from a hearth feature in Block 106 of the site. The charcoal was identified to be Poplar and dated to CZ3b at 12,418-12,611 cal BP. Sample 2011-10 was charcoal collected from a hearth in Block 106 about 5-10cm below feature 2011-9 (Figure 4.5). This sample was identified as Birch as was dated 12,753-13,117 cal BP. Although Features 2011-9 and 2011-10 are overlapping, the dates better show that these hearths belong to separate cultural zones.

Table 6.1 Radiocarbon dates

Lab #	Wt. (g)	Taxa	Depth (cmBS)	Context	C14 Age	Cal BP Age* (2σ)
Beta-264526	0.4	charcoal	95-100	Hearth, Feature 2011-8, CZ3b	10140 ± 50	12,035-11,411
Beta-264527	0.2	charcoal	90-95	Upper Paleosol, bottom, CZ3b	10160 ± 50	12,045-11,614
Beta-337171	0.11	Betula spp.	85-95	Hearth, Feature 2011-5, CZ3b	10220 ± 40	12,079-11,768
Beta-342449	0.04	Populus spp.	90-95	Feature 2011-9, CZ3b	10560 ± 40	12,418-12,611
Beta-337174	0.06	Betula spp.	115-120	Hearth, Feature 2011-10, CZ4	11080 ± 50	13,117-12,753
Beta-337172	0.01	Populu/Salix	110-115	Hearth, Feature 2011-6a, CZ4	11100 ± 50	13,130-12,766
Beta-264530	0.2	charcoal	110-115	Lower Paleosol, bottom, CZ4	11210 ± 60	13,274-12,905
Beta-264522	13.8	bone	150-160	lower sands	11460 ± 50	13,440-13,196
Beta-312937	0.1	Betula spp.	85-90	Feature 2011-4, CZ1b	3780 ± 30	4224-4008
Beta-264525	0.1	bone	40-45	Middle of C1 horizon, CZ2	4580 ± 40	5448-5053
Beta-264529	0.2	charcoal	30-35	Bottom of lowest B horizon	4940 ± 40	5743-5596
Beta-264524	0.4	charcoal	50-55	Middle of C1 horizon, CZ2	6050 ± 40	7004-6786
Beta-264528	0.1	charcoal	80-85	Upper Paleosol, top	7790 ± 50	8695-8428

*All dates calibrated using Calib software with Intcal09 calibration curve (Reimer et al. 2009)

6.3 Features

A total of seven features were identified in the 2009 and 2011 excavations at Mead (Figure 6.1). One cache pit (2011-4) and six hearths (2011-5, 2011-6, 2011-7, 2011-8, 2011-9, 2011-10) have been uncovered at the East Block of the site. Features in CZ2 and CZ3a were not found until the 2012 excavation season therefore they will not be discussed in this analysis. The presence and absence of fauna as well as frequencies of flakes and the variable sizes of the hearths shows that the hearths and the associated activities at Mead are not uniform (Potter et al. 2011). This variability will be explored in more detail in this chapter. The description and analysis of hearths in the following section are meant to aid in activity area analysis and are discussed in order of cultural zone.

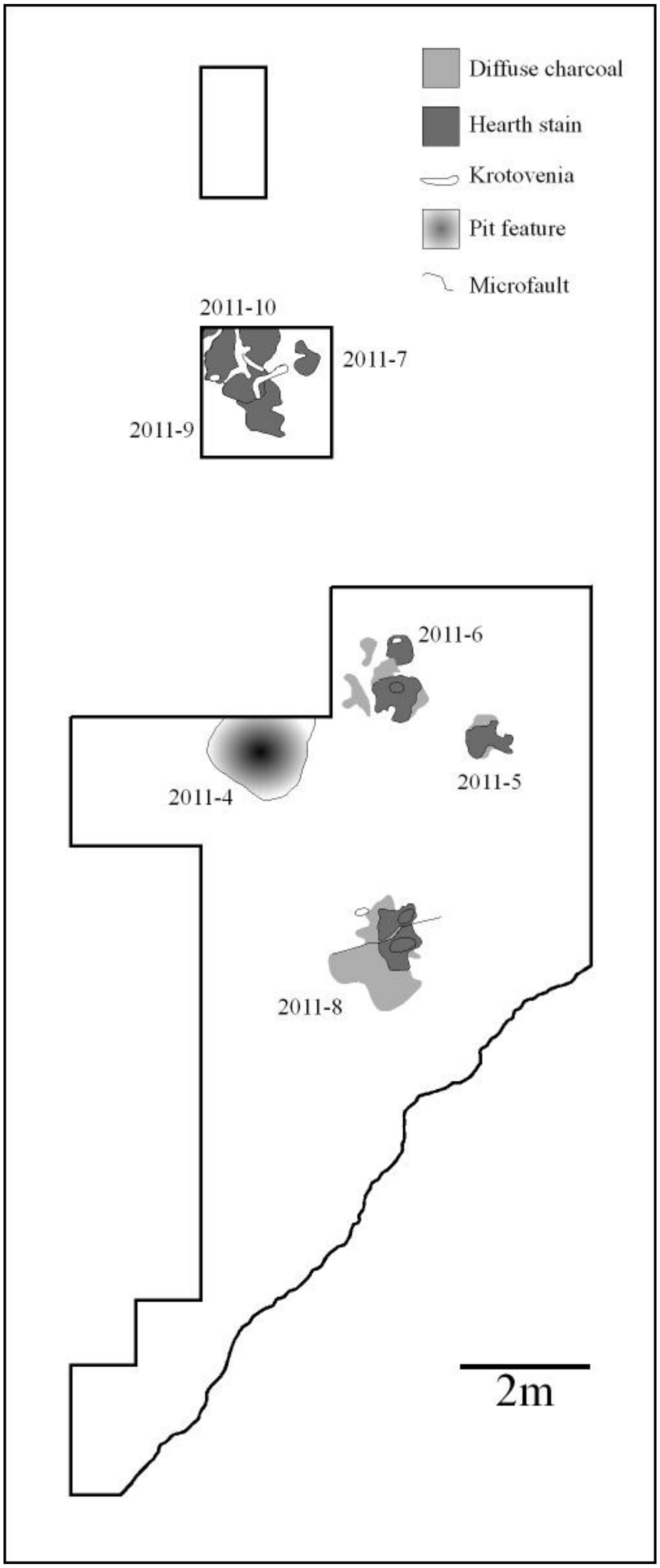

Figure 6.1 All features from 2009 and 2011 excavations

6.3.1 CZ1b

This cultural occupation contains a single feature. Feature 2011-4 is a pit feature interpreted to be a cache pit. The feature was only partially excavated in 2011, and the remaining portion was excavated in 2012. Descriptions here will include information from the 2012 excavation in order to give the full known dimensions of the feature. The feature is circular, measuring roughly 1.8 m in diameter. It was first found at around 35 cm BS but not confirmed as a pit feature until 50 cm BS. The feature extends to 95 cm BS. The inner fill is charcoal rich and the outer ring is reddened silt. A total of 85 flakes and three bone fragments are directly associated with this feature. Subareas B1, B3 and B4 in nearby blocks (see below) are associated with this feature as well. Unburned birch bark was found at the bottom of this pit in 2011, in 2012, 76 gastroliths were also found at the bottom of the feature in a 2 cm^2 area, suggesting bird were possible stored here.

Figure 6.2 Feature 2011-4 with birch bark

6.3.2 CZ3b

A total of four hearth features were found in CZ3b. Feature 2011-5 is a hearth feature with well-defined edges and some evidence of smearing of the stain. It was located 85-90 cm BS. A total of 135 lithic artifacts and over 30 bone fragments as well as scattered gastroliths are associated with Feature 2011-5. This feature is associated with Area G in block 102, E46 and E52.

Figure 6.3 Feature 2011-5

Feature 2011-7 (Figure 6.4) was found in Block 106 at 95 cm BS. Although there is a small number of bone fragments associated with this feature no flakes were found in related context. The placement of this hearth in CZ3b is problematic. The hearth is about 20cm below the CZ3a flakes found in the same Block, but is also well above any flakes and the hearth feature in the same Block associated with CZ3b (see Figure 6.5). Excavations in 2012 revealed that there are likely two different occupations in CZ3b, however for the purpose of this project feature 2011-7 is being labeled as part of CZ3b.

Figure 6.4 Feature 2011-7

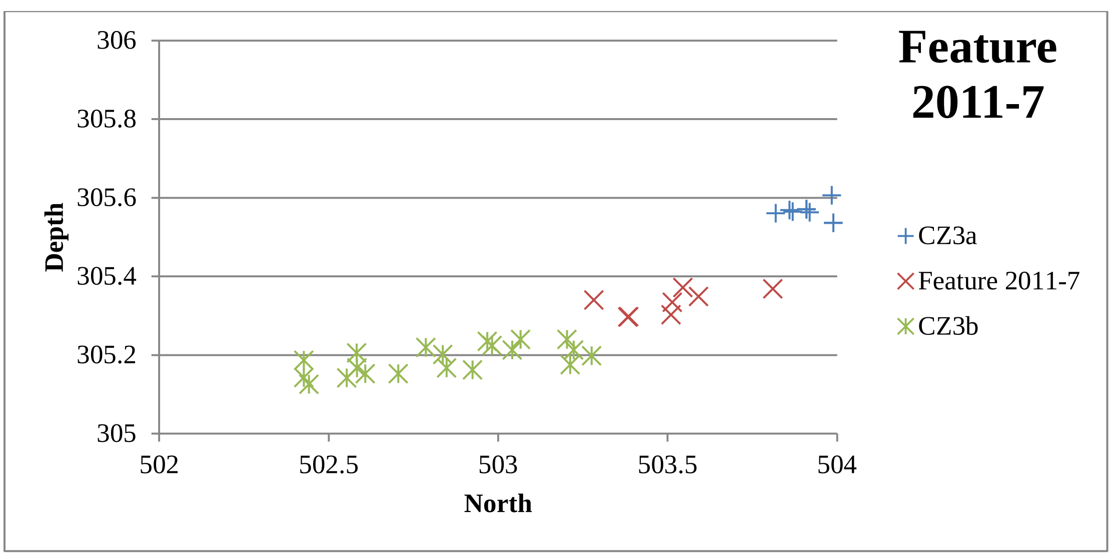

Figure 6.5 Back plot of Feature 2011-7 showing relationship to CZ3a and CZ4

Feature 2011-9 was located 100-110 cm BS. In total there were 34 bones, 19 flakes and 11 FCR found directly associated with this feature. The feature is a dark stain with clearly defined edges and intact pieces of charcoal found within the matrix. It measures 95cm at its maximum spread in the north-south direction and 70 cm at its maximum spread in the east-west direction.

Figure 6.6 Feature 2011-9, north towards bottom left corner

Feature 2011-8 is a large hearth feature measuring 100cm in the North-South direction and 70cm in the East-West direction. Unlike Feature 2011-9 found in the same cultural occupations, Feature 2011-8 is diffuse, with unclear boundaries and contains much more cultural material. This hearth was first identified in 2009, however the largest portion was excavated in 2011. There was a microfault running through the feature from the southwest corner of the Block to the northeast corner. A total of 204 lithic artifacts, 341 bone fragments, as well as 87 fire cracked rocks were found directly associated with this feature.

Figure 6.7 Feature 2011-8

6.3.3 CZ4

A total of two hearth features were found in this cultural occupation. Feature 2011-6 was 110-115 cm below surface in Block 101 (Figure 6.8). It is located 10-15 cm below Feature 2011-5 in a nearby Block (Figure 6.9). It was found in two separate lenses with clear boundaries marking the separation. 2011-6a (north lens) is a circular stain that measures about 45cm in diameter. 2011-6b (south lens) is an amorphous stain measuring 70 cm in the north-south direction and 80 cm in the east-west direction. Both 2011-6a and 2011-6b have clear boundaries but are also associated with diffuse charcoal smears, making the overall stain over a meter in maximum dimension. A total of 245 lithic artifacts and 13 bone fragmnets are directly associated with this feature.

Figure 6.8 Feature 2011-6a (upper), and 2011-6b (lower)

Figure 6.9 Feature 2011-6 (left) showing separation from 2011-5 (right)

Feature 2011-10 is a hearth located in Block 106. The bulk of this feature was excavated in 2011 with the remaining portion excavated in 2012. Information from 2012 will be included here in order to report on the total dimensions of the feature. 2011-10 measures 160 cm in the north-south direction, and 125 cm in the east-west direction. A total of 18 lithics artifacts and 102 bone fragtments as well as 35 fire cracked rocks were found directly associated with this feature.

Figure 6.10 Feature 2011-10, north towards right

6.4 Area Analysis

6.4.1 CZ1b

In CZ1b there are a total of 3 areas, 6 subareas and 18 discrete clusters consisting of brown quartzite, grey quartzite, grey chert, brown chert, black basalt, and rhyolite. MSRT and Attribute Analysis were used for lithic analysis for each cluster in CZ1b.

Area A

No subareas were defined for this area. Area A is located in Block 107 and represents a total of three clusters: brown quartzite (n=11), grey chert (n=1258), rhyolite (n=203). Not contained within these clusters but confined within the boundaries of Area A is one formal tool, a grey basalt boulder spall scraper. Only two other small flakes of grey basalt are found in this area suggesting the boulder spall scraper was manufactured elsewhere.

The majority of flakes from the brown quartzite cluster are ranked as SC4 with three flakes as SC2, one flake as SC6 and one flake as SC16. The large flakes suggest some core reduction occurred with medium and large flakes being removed and further reduced for use as tools or blanks. Other evidence supports core reduction: all present platforms are simple, and all flakes have less than 3 dorsal scars. The lack of cortex in this cluster may suggest prepared cores were being reduced rather than original cobbles.

The grey chert cluster contains a total of 1,258 flakes. Three flakes have cortex present. Out of the 129 complete flakes 109 (85.0%) have less than three dorsal scars and 20 have three or more dorsal scars. There are a total of 10 (0.8%) modified grey chert flakes in this cluster. Of the 399 flakes that have discernible platforms the largest proportion are simple (n=338, 84.7%) there are also a total of 47 (11.8%) complex platforms, and interestingly 14 (3.5%) prepared platforms, a higher than usual number. With 119 (49.9%) platforms lipped, the evidence here suggests some prepared core reduction and tool production occurred with biface reduction occurring as well. The MSRT data supports this. An equal percentage of broken and complete flakes next to a high percentage of fragments in the medium size class suggest tool production. The distribution of flakes in the small and very small categories suggests biface reduction. All together the evidence suggests the majority of this cluster was secondary stage reduction focused on the production of tools and biface reduction.

Table 6.2 MSRT summery for Area A, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	186 (18.7%)	103 (10.4%)	690 (69.3%)	2 (0.2%)	14 (1.4%)
Small	74 (30.6%)	23 (9.5%)	144 (59.5%)	0 (0.0%)	1 (0.4%)
Medium	2 (20.0%)	2 (20.0%)	6 (60.0%)	0 (0.0%)	0 (0.0%)
Large	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)

A total of four flakes have cortex present in the rhyolite cluster in CZ1b. Out of the 21 complete flakes, 14 (66.7%) have less than three dorsal scars and 7 (33.3%) have three or more scars. Of the 55 flakes with discernible platforms, 97.3% have simple platforms. The frequency of simple platforms and percentage of flakes with low dorsal scar counts suggest core reduction occurred. The MSRT data suggests tool production and biface reduction were also occurring. The higher percentage of broken flakes in the medium category indicate a focus on tool production while the familiar distribution of high fragments, low broken flakes, and very low complete flakes in the small and very small categories suggests biface reduction.

Table 6.3 MSRT summery for Area A, rhyolite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	9 (10.8%)	7 (8.4%)	65 (78.4%)	2 (2.4%)	0 (0.0%)
Small	14 (13.5%)	12 (11.5%)	77 (74.0%)	0 (0.0%)	1 (1.0%)
Medium	7 (43.8%)	2 (12.5%)	6 (37.5%)	0 (0.0%)	1 (6.3%)

In summary, Area A is relatively dense when compared to other areas in CZ1b. Work in this area focused on core reduction and flake production of brown quartzite, and tool production and maintenance on high quality materials. The presence of a discarded boulder spall scraper also indicates that tool maintenance was a primary goal in this area.

Figure 6.11 CZ1b Block 107 Area A

Area B

This area contains four subareas, associated with the pit feature in CZ1b. The subareas are dense with well-constrained boundaries. A total of six raw materials are found in this area: black basalt, grey chert, brown chert, brown quartzite, grey quartzite, and rhyolite.

Subarea B1: This subarea is located primarily in Block 101. B1 contains a total of three distinct clusters: brown quartzite (n=99), grey quartzite (n=8), grey chert (n=9)

A total of two flakes in the brown quartzite cluster of CZ1b have <50% cortex coverage, one flakes has >50%cortex, and two have complete 100% cortex on their dorsal surface. Of the 18 complete flakes 88.9% have less than two dorsal scars. Of the 46 flakes with discernible platforms 43 (93.5%) have simple platforms, two (4.3%) have cortical platforms and one (2.2%) has a complex platform. The frequency of these attributes suggests core reduction occurred. The MSRT data supports this. The high percent of complete flake in the large size class suggests core reduction. The distribution of flakes in the medium categories along with the presence if split flakes is consistent with expectations for large core reduction as well.

Table 6.4 MSRT summary for subarea B1, brown quartzite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	1 (11.1%)	2 (22.2%)	6 (66.7%)	0 (0.0%)	0 (0.0%)
Small	15 (28.8%)	9 (17.3%)	28 (53.8%)	0 (0.0%)	0 (0.0%)
Medium	8 (25.8%)	3 (9.7%)	16 (51.6%)	1 (3.2%)	3 (9.7%)
Large	2 (28.6%)	4 (57.1%)	1 (14.3%)	0 (0.0%)	0 (0.0%)

Two flakes of grey quartzite are SC2, 2 flakes are SC4, and one flake each belong to SC5, SC7, SC8, and SC13. One flake has less than 50% cortex coverage on its dorsal surface and the two complete flakes found in this cluster have 3 dorsal scars. The medium to large size classes of half of the flake sin this cluster suggest core reduction. This is supported by the presence of cortex. Dorsal scars count may indicate tool production however both complete flakes where dorsal scars were counted are on medium sized flakes, not small sizes. The signatures of grey quartzite core reduction further implicate this raw material as a local source.

The grey chert cluster in subarea B1 consists of 9 waste flakes and 1 modified flake. Of the debitage, a single flake is SC1, three flakes are SC2, and four flakes are SC3. No cortex is present on any flakes in this cluster. Of the three complete flakes 1 flake has a total of 1 flake scar, and two have two flake scars. The absence of cortex as well as the small sizes of the flakes and presence of a modified flake indicates tool reduction occurred here.

Subarea B2: This subarea is primarily located in Block 102. There is a single cluster of grey chert with a total count of 24 flakes. A total of six flakes are classed as SC1, fifteen flakes are SC2, and three flakes are SC3. One flake has a prepared platform while all six other platform-bearing flakes have simple platforms. No cortex is present on any flakes. The absence of cortex and small size of flakes suggests that tool reduction occurred however the high frequency of simple platforms may indicate tool production.

Subarea B3: Located in Block E44, this subarea contains a single cluster of grey chert with 199 flakes total. Out of 66 total platform-bearing flakes seven have complex platforms and 59 have simple platforms. There are 21 flakes in SC1, 105 flakes in SC2, 55 flakes in SC3, 11 flakes in SC4, and five flakes in SC5. There are a total of two flakes with less than 50% cortex coverage on their dorsal surface. There are also a total of two grey chert modified flakes in this cluster. Out of the 24 complete flakes four flakes have just one scar, 13 have two scars, four flakes have three scars, one has four scars, and two flakes have more than 4 scars. Considering the presence of complex platforms with the modified flakes and the small size of the flakes, it is likely that some tool or biface maintenance occurred here. The data also suggest with the low counts of dorsal scars, presence of cortex and abundance of simple platforms that there was tool production occurring as well.

Table 6.5 MSRT summary for Subarea B3, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	21 (17.5%)	12 (10.0%)	87 (72.5%)	0 (0.0%)	0 (0.0%)
Small	23 (29.9%)	10 (13.0%)	44 (57.1%)	0 (0.0%)	0 (0.0%)

Subarea B4: This subarea is located mainly in Block 105 of the site. There are a total of six clusters within the boundary: black basalt (n=6), brown chert (n=6), brown quartzite (n=6), grey chert (n=576), and rhyolite (n=346).

Four flakes in the black basalt cluster are SC2 and two flakes are SC3. A single flake has 100% cortex coverage and the three platform-bearing flakes all have simple platforms. There are a total of two complete flakes whose dorsal scars could be counted, one flake has no scars and the other has 2 scars. The presence of cortex and the low dorsal scar counts mixed with the small size of the flakes indicate secondary reduction, likely starting from small cores or blanks.

Three flakes in the brown chert cluster are SC2 and three are SC3. There is no cortex found on any flakes in this cluster and no complete flakes. One flake has a simple platform and one flake has a complex platform. Although the sample size is small, the lack of cortex, complex platform, and small size of the flakes suggest tertiary reduction indicating, tool maintenance.

Three flakes from the brown quartzite cluster are SC2 and one flake each are in SC3, SC5, and SC6. There are a total of three platform-bearing flakes in this cluster, all having simple platforms. The single complete flake has one dorsal scar. The relatively larger sizes of flakes, low dorsal scar count and simple platforms suggest core reduction however the lack of cortex may indicate secondary stage core reduction focused on flake production.

A total of 29 flakes in the grey chert cluster were classes as SC1, 355 flake are SC2, 129 flakes are SC3, 31 are categorized as SC4, 12 flakes are SC5, six are classes as SC6, two flakes are SC7, and one flake each are classed as CS8, SC9, and SC10. Out of 192 platform bearing flakes, 27 have complex platforms, one flake platform is cortical, four are prepared, and 160 flakes have simple platforms. A total of two flakes have less than 50% cortex coverage. There are a total of 53 complete flakes, 13 with one dorsal scar, and 21 with two scars, 15 with three scars, two with four scars, and two with more than four scars. There are also eight modified grey chert flakes and one grey chert burin spall. The presence of modified flakes as well as a 14% representation of complex platforms and the majority of flakes being in small size classes suggests that tool maintenance occurred here. This is also suggested by the presence of a burin spall, either in the fact that maintenance was the focus or that as sharpening occurred a tool was broken and burinated. However the presence of larger size class flakes, and the majority of simple platforms as well as some cortex suggests that core reduction or tool production occurred. The MSRT data show similar signals. The higher percentage of complete flakes in the medium size class indicates core reduction. The presence of split flakes and high number of fragments, with the next most represented category being broken flakes and very low percentage of complete flakes in both the small and very small categories indicates biface reduction occurred, probably using soft hammer percussion.

Table 6.6 MSRT summary for Subarea B4, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	82 (22.0%)	30 (8.1%)	249 (66.9%)	2 (0.5%)	9 (2.4%)
Small	48 (26.2%)	18 (9.8%)	114 (62.3%)	1 (0.6%)	2 (1.1%)
Medium	0 (0.0%)	3 (25.0%)	9 (75.5%)	0 (0.0%)	0 (0.0%)

The rhyolite cluster in this subarea has a total of 346 flakes. A total of 83 flakes are SC1, 175 flakes are classed as SC2, 64 flakes are SC3, 18 flakes are SC4, three flakes are classed as SC5, two are categorized as SC6, and one flake is SC7. Of the platforms found, 83 are simple, two are cortical, and eight are complex. Of the complete flakes, 13 have one dorsal scar, 10 flakes have two scars, and three flakes have three dorsal scars. The attributes analysis suggests that both tool production and tool maintenance occurred. The MSRT data also suggests that tool production and biface reduction were both occurring in this cluster (Table 6.7). This is shown by the higher percentages of complete flake sin the medium size category, as well as the familiar distribution of a high percent of fragments, reduced percentage of brown flakes, and low percentage of complete flakes. Similar to the grey chert cluster in this subarea both attribute analysis and MSRT data indicates that the rhyolite is being reduced both as a core or blank and as later stage tools. This may indicate that the rhyolite in this assemblage is more local than originally thought.

Table 6.7 MSRT summary for Subarea B4, rhyolite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	40 (15.6%)	23 (9.1%)	192 (75.3%)	0 (0.0%)	0 (0.0%)
Small	27 (31.0%)	2 (2.3%)	58 (66.7%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)	0 (0.0%)

In summary, Area B has relatively distinct boundaries for subareas when compared to other areas in CZ1b. Work in this area focused on core reduction and flake production of lower quality materials such as brown quartzite, grey quartzite, and black basalt. For higher quality materials such as grey chert, rhyolite, and brown chert, tool production and maintenance, including the production and maintenance of bifaces, was the focus.

Area C

This area is a diffuse scatter when compared with the very dense concentrations typical of CZ1b. There are two defined subareas with a total of four different raw materials: black chert, brown quartzite, grey quartzite, and grey chert.

Subarea C1: This subarea is a diffuse scatter located primarily in Blocks E25, 26, 16, and 17. There are a total of four clusters consisting of black chert (n=42), brown quartzite (n=337), grey quartzite (n=223), grey chert (n=151).

The black chert cluster has a total of 42 flakes. There is no cortex found on any flakes, and of the 9 complete flakes one has one dorsal scar, four have two dorsal scars, two have three dorsal scars, and one flake each has four and over four dorsal scars. A total of two flakes have complex platform while 21 flakes have simple platforms. Attributes suggest tool production occurred. The MSRT data shows high percentages of broken flakes, especially in the small size category, and higher complete flakes in the very small category also indicate tool production was most likely the focus.

Table 6.8 MSRT summary for Subarea C1, black chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	8 (25.0%)	8 (25.0%)	16 (50.0%)	0 (0.0%)	0 (0.0%)
Small	6 (60.0%)	1 (10.0%)	3 (30.0%)	0 (0.0%)	0 (0.0%)

The brown quartzite cluster in this subarea contains 337 flakes. Notably, three brown quartzite cores are also found in this subarea indicating that core reduction occurred. A total of two flakes with have less than 50% cortex coverage and 1 flake has 100% cortex. Of the 36 complete flakes 18 have one dorsal scar, nine have two scars, eight have three scars, and one flake has over four dorsal scars. All 83 flakes with their proximal end intact have simple platforms. The MSRT data shows that there is a high percentage of complete flakes and presence of shatter in the very large and large categories, with the medium, small and very small size categories having higher representation by fragments and broken flakes. Both the attribute analysis and the MSRT data suggest that core reduction occurred, with the focus on producing medium sized flakes.

Table 6.9 MSRT summary for Subarea C1, brown quartzite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	9 (5.7%)	14 (8.8%)	135 (84.9%)	1 (0.6%)	0 (0.0%)
Small	21 (19.9%)	7 (6.4%)	80 (72.7%)	2 (1.8%)	0 (0.0%)
Medium	7 (18.9%)	4 (10.8%)	24 (64.9%)	2 (5.4%)	0 (0.0%)
Large	5 (18.5%)	10 (37.1%)	8 (29.6%)	1 (3.7%)	3 (11.1%)
Very large	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

The grey quartzite cluster has a total of 223 flakes. One flake have less than 50% cortex. Of the 15 complete flakes, six have one dorsal scar, six flakes have two scars, and three flakes have a count of three dorsal scars. All 34 of platform-bearing flakes have simple platforms. The MSRT data shows a higher percentage of complete flakes in the large size category and the presence of shatter in the medium category. The small and very small categories have a very high percentage of fragmented flakes typically seen throughout the site. The data suggest that core reduction occurred on this grey quartzite.

Table 6.10 MSRT summary for Subarea C1, grey quartzite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	5 (4.9%)	6 (5.9%)	89 (87.2%)	1 (1.0%)	1 (1.0%)
Small	6 (7.9%)	2 (2.6%)	66 (86.9%)	1 (1.3%)	1 (1.3%)
Medium	3 (8.8%)	4 (11.8%)	24 (70.6%)	2 (5.9%)	1 (2.9%)
Large	2 (18.2%)	3 (27.3%)	5 (45.5%)	1 (9.1%)	0 (0.0%)

The grey chert cluster counts 151 flakes. No flakes have any cortex. Of the 30 complete flakes, five flakes have a count of one dorsal scar, 12 flakes have two scars, 11 flakes count three scars, and one flake each have four and more than four dorsal scars. Three platforms are categorized as complex, with two platforms typed as crushed. The remaining 65 platforms are simple. Attributes indicate secondary reduction. The MSRT data furthers this outcome by suggesting tool production occurred seen by the higher percentages of broken flakes in the small and very small categories.

Table 6.11 MSRT summary for Subarea C1, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	25 (26.0%)	15 (15.6%)	56 (58.3%)	0 (0.0%)	0 (0.0%)
Small	17 (32.1%)	15 (28.3%)	20 (37.7%)	0 (0.0%)	1 (1.9%)
Medium	0 (0.0%)	0 (0.0%)	2 (100.0%)	0 (0.0%)	0 (0.0%)

Subarea C2: This subarea is located primarily in Block 104 and most likely continues into the unexcavated unit to the west. There is a single cluster of grey chert totaling 20 flakes in this subarea. One flake is classes as SC1, 14 flakes are SC2, four flakes are SC3, and a single flake is classes as SC4. No flakes contain any cortex. There are a total of two complex platforms and eight simple platforms found on flakes with their proximal segments intact. Of the 3 complete flakes, one flake each has two flake scars, three flakes scars and four flake scars. The heavy representation of small size flake in addition to the absence of cortex, presence of complex platforms and the high dorsal scar counts suggests tool reduction and most likely some biface maintenance occurred.

In summary Area C follow typical patterns seen for CZ1b, although spatially is less dense. Core reduction occurred on the lower quality quartzite materials while tool/biface production and maintenance occurred on high quality chert materials.

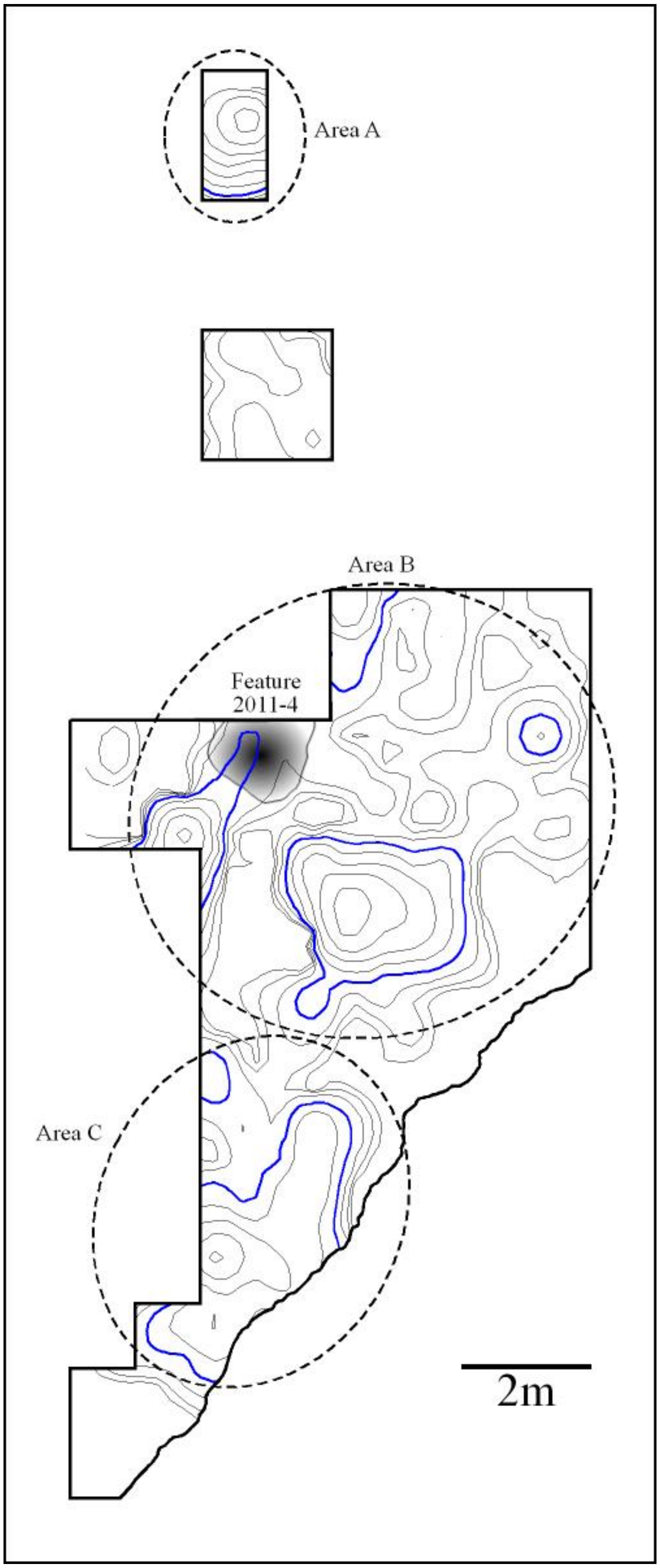

Figure 6.12 CZ1b isopleth map with area borders and feature 2011-4

6.4.2 CZ2

Cultural Zone 2 has a total of 2 areas, containing one subarea each with a total of 8 discrete clusters. Compared to CZ1b, the overall spread of lithics in CZ2 is more spatially discreet with well-defined area boundaries, and a abundance of space that is completely lacking lithic artifacts.

Area D

Area D contains a single subarea. Subarea D1 is located primarily in Blocks 104, and E26. There are a total of 6 clusters including banded chalcedony (n=8), black chert (n=6), brown quartzite (n=27), grey quartzite (n=6), grey chert (n=1014), and rhyolite (n=5).

The banded chalcedony cluster has a total of eight flakes. There is no cortex found and of the two complete flakes, one flake each have a count of 3 and 4 dorsal scars. Two flakes are classes as SC1 and the remaining six are SC2. All five platform-bearing flakes have simple platforms. The data suggests that tool reduction occurred, however the absence of complex platforms suggests this was early stage maintenance.

The black chert cluster has a total of 6 flakes. No flakes have any cortex and no flakes are complete. Three flakes each have been classed as SC1 and SC2 and only one platform was identified as simple. Although there is a limited sample size, the lack of cortex, and small size of the flakes, as well as the singular simple platform suggest the formation of tools was the focus for black chert.

There are a total of 27 flakes in the brown quartzite cluster. A single flake has 100% of its dorsal surface covered in cortex. Out of the seven complete flakes, one flake has 1 dorsal scar, five have 2 dorsal scars, and one has 3 scars. There are a total of 12 simple platforms present in this cluster. Size classes count eight flakes in SC2, three flakes in SC3, seven flakes in SC4, four flakes in SC5, two flakes in SC9, and one flakes each in SC6, 7, and 8. Given the larger flake sizes in this cluster as well as the presence of a completely cortex covered flake, the high number of simple platforms, and low number of dorsal scars, this brown quartzite cluster is representative of core reduction.

In the grey quartzite cluster there a total of six flakes. No flakes have any cortex and the single complete flake has 2 flakes scars. There is one simple platform in this cluster and size classes are distributed with three flakes in SC2, and one flake each in SC3, 7, and 10. The larger flakes sizes, simple platform, and low dorsal scar count, along with the absence of cortex suggest secondary core reduction from a worked core or blank.

There are a total of 1014 flakes made from grey chert in this subarea. A single flake has less than 50% cortex and one flake has over 50% cortex coverage on its dorsal surface. Of the 128 complete flakes, 57 flakes have a count of 1 dorsal scar, 37 have 2 scars, 20 have 3 scars, 11 have 4 scars, and three have over 4 scars. There are also three grey chert modified flakes and 1 grey chert microblade. The MSRT data shows that there one flake in the large category and the distribution of flakes in the medium category, a large percentage of complete flakes, suggests soft hammer core reduction occurred. However, signals for the small and very small categories represent biface reduction. The culmination of both the attribute analysis and MSRT data suggests that there was a broad spectrum of reduction occurring on this grey chert, from core reduction to tool production and biface maintenance.

Table 6.12 MSRT summary for Area D, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	146 (19.2%)	85 (11.2%)	552 (68.7%)	3 (0.4%)	4 (0.5%)
Small	62 (27.0%)	38 (16.5%)	129 (56.1%)	0 (0.0%)	1 (0.4%)
Medium	2 (10.5%)	5 (26.3%)	12 (63.2%)	0 (0.0%)	0 (0.0%)
Large	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)

There are five rhyolite flakes in this cluster. There is no cortex found in any flake and the single complete flake has 4 dorsal scars. There is one flake each in SC1, 2 and 3, and two flakes in SC6. The single platform found in this cluster is simple. The absence of cortex, but presence of medium sized flakes and simple platforms suggest tool production occurred.

Area E

Area E contains a single subarea. Subarea E1 is located in Block 106 of the site. It contains a total of two clusters including brown quartzite (n=17), grey chert (n=838).

The brown quartzite cluster contains a total of 17 flakes. A single flake has less than 50% cortex coverage. Of the three complete flakes one each has 2, 3, and 4 dorsal flake scars. A single flake is classes as SC1, five flakes are SC2, one flake is SC3, three flakes are classed as SC4, two flakes are SC5, and one flake each is classes as SC6, 7, 8, 11, and 21. Of the seven flakes with platforms present, six have simple platforms and one has a cortical platform. The presence of a cortical platform, as well as large sized flakes indicates large core reduction of brown quartzite occurred in this area.

There are a total of 838 grey chert flakes in this subarea. There is no cortex present on any flakes. Of the 164 complete flakes, 79 have 1 dorsal flake scar, 44 have 2 scars, 26 have 3 scars, 7 have 4 scars, 8 have >4 scars. Notably there are three 3 grey chert bifaces discarded in early stage of use found in this cluster. The MSRT data shows a high percentage of complete flakes in the medium size category indicating hard hammer core reduction. However the small and very small size categories have an increase in the representation of broken flakes suggesting biface manufacture. The attribute analysis as well as the MSRT data shows that both grey chert core reduction and biface manufacture and reduction occurred in this area. This conclusion is greatly supported by evidence found in 2012 were numerous preforms and primary reduction of original chert cobbles was excavated in nearby association.

Table 6.13 MSRT summary for Area E, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	146 (22.0%)	113 (17.0%)	401 (60.5%)	0 (0.0%)	3 (0.5%)
Small	43 (27.7%)	42 (27.1%)	69 (44.5%)	0 (0.0%)	1 (0.6%)
Medium	3 (17.6%)	9 (52.9%)	5 (29.4%)	0 (0.0%)	0 (0.0%)

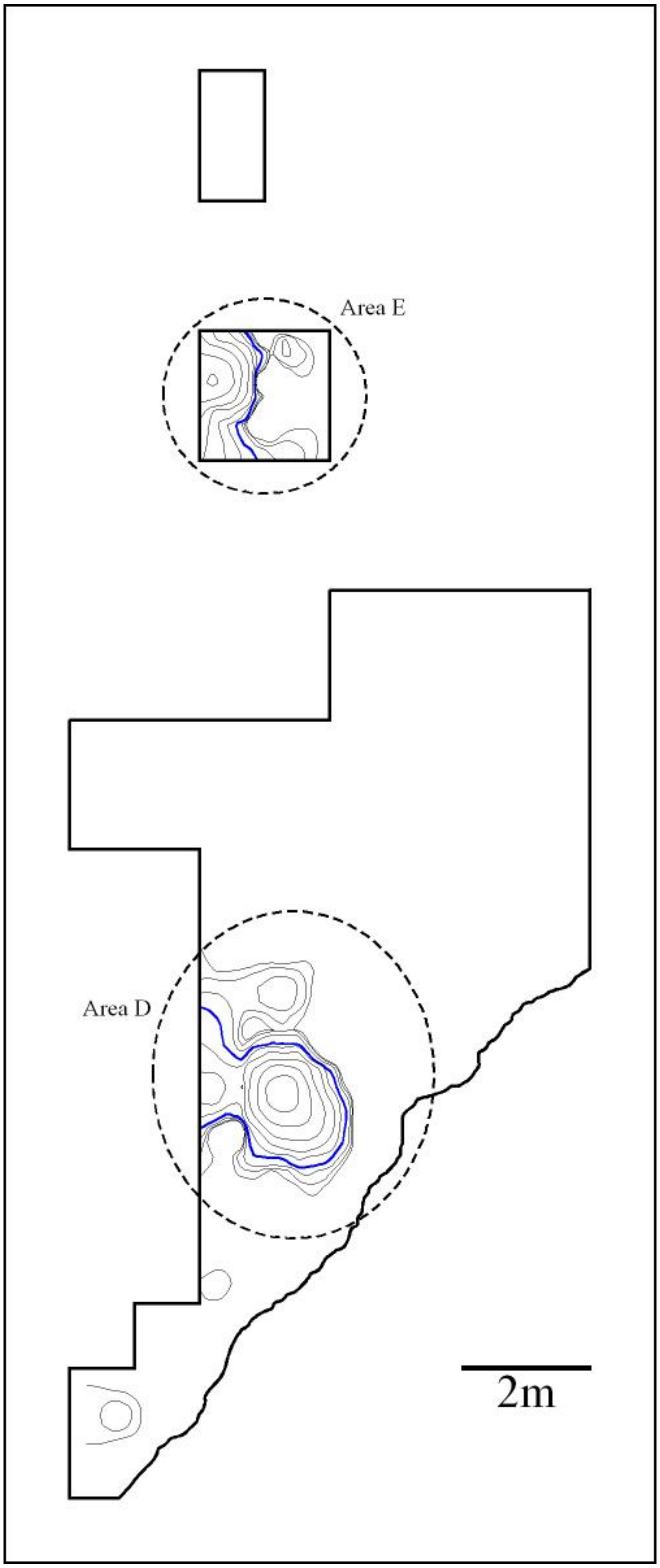

Figure 6.13 CZ2 isopleth map with cluster borders

6.4.3 CZ3a

Since subarea boarders are defined by densities of eight or higher, CZ3a had no technical subarea definition. All flakes (n=13) are in the northern and eastern portions of Block 106. There are a total of four complete flakes, one broken, and eight fragmented flakes. No cortex is present on any flakes. Of the complete flakes, two had two flake scars, one had three flakes scars and one had over four flake scars.

6.4.4 CZ3b

This cultural zone contains a total of three lithic areas each with one subarea. All together there are a total of 12 discrete clusters. Two out of the three subareas are closely associated with hearth features.

Area F

There is a single subarea defines for Area F. Subarea F1 is located in Block 107. It contains a total of 3 clusters including banded chalcedony (n=29), grey chalcedony (n-9), and grey chert (n=74).

There are a total of 29 banded chalcedony flakes in this cluster. There is no cortex found on any flake. Of the five complete flakes, four have 2 flake scars, and one has 4 flake scars. Size classes are distributed with five flakes in SSC1, 22 flakes in SC2, and one flake in SC3. There are 3 complex platforms and 14 simple platforms found. There is also one modified flake found in this cluster. With the representation of complex platforms and small flake sizes, as well as the presence of modification, it is likely that the banded chalcedony in this cluster resulted from tool and biface maintenance.

There are 9 grey chalcedony flakes in this cluster. No cortex is found on any flake. There is a single complete flake with 2 flake scars. Size classes are assigned with two flakes in SC1, six flakes in SC2, and one flake in SC3. There are 5 simple platforms and 1 crushed platforms. The absence of complex platforms, suggests biface maintenance was not occurring, however this could be due to small sample size. The presence of a crushed platform suggests hard hammer reduction occurred, which indicates tool production, however it was most likely late stage production based on the distribution of flake sizes.

This grey chert cluster consists of 74 flakes. No cortex is found on any flake. Of the 16 complete flakes seven have 1 flake scar, and nine have 2 flake scars. There are a total of four complex platforms and 31 simple platforms. The attributes suggest biface and tool maintenance may be occurring. The MSRT data shows a nearly even distribution of broken flakes and fragmented flakes in the small size category. Given the high percent of fragments through the site assemblage, the high percent of broken flakes here suggests tool production. However the very small category suggests biface reduction, with some pressure flaking occurring to boost the numbers of complete flakes.

Table 6.14 MSRT summary for Area F, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	15 (24.2%)	15 (24.2%)	31 (50.0%)	1 (1.6%)	0 (0.0%)
Small	5 (41.7%)	1 (8.3%)	6 (50.0%)	0 (0.0%)	0 (0.0%)

Area G

A single subarea was defined for Area G. Subarea G1 is located in Blocks 102, E46, and E52. There are a total of two clusters including grey chert (n=7), and quartz (n=84). This subarea is also associated with hearth feature 2011-5. Artifacts in this subarea are mostly (73%) flakes from ventifacted quartz cobbles, but there is also a large number of bone fragments occurring in this area.

The grey chert cluster consists of seven flakes. No cortex is found on any flake and size classes included two flakes in SC1, three flakes in SC2, and two flakes in SC3. There are no complete flakes and a total of three simple platforms. The distribution of platform types in addition to the small size classes suggests tool maintenance was the focus for grey chert reduction in this area.

The quartz cluster has a total of 84 flakes. No cortex, either as a ventifacted or weathered surface, was found on any flake and of the 20 platforms identified, all are simple. Of the seven complete flakes found, three flakes have 1 flake scar, two have 2 scars, and 2 have three scars. Additionally, there is one multidirectional quartz core found in this area. The data suggests that core reduction occurred however due to the lack of cortex on the flakes, it is most likely secondary reduction occurring on a prepared or previously worked core. The MSRT data shows only medium, small and very small size categories suggesting primary reduction, where the expectation is a higher representation of larger flakes, did not occur. The distribution of flakes in MSRT categories actually matches signatures for tool maintenance with a high number of fragments, a decreased number of broken flakes, and a low percentage of complete flakes.

Together, the data suggests both secondary and tertiary reduction occurred here, with some core reduction, as well as some tool production and maintenance.

Table 6.15 MSRT summary for Area G, quartz cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	8 (12.1%)	5 (7.6%)	52 (78.8%)	0 (0.0%)	1 (1.5%)
Small	4(26.7%)	2 (13.3%)	9 (60.0%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)

Area H

A single subarea was defined for Area H. Subarea H1 is located primarily in Blocks 105, and E32. It contains a total of seven discrete clusters including andesite (n=37), banded chalcedony (n=10), brown quartzite (n=6), grey quartzite (n=7), grey basalt (n=19), grey chalcedony (n=18), and grey chert (n=68). This subarea is also associated with a large hearth feature 2011-8, in addition to numerous bone artifacts.

The andesite cluster consists of 37 flakes. Two flakes were found to have less than 50% cortex coverage each. Two cortical platforms, in additional to 10 simple platforms were also identified. No complete flakes were found. The attributes suggest secondary stage core reduction occurred, which is partially supported by the MSRT data. Distribution of the flakes into the MSRT categories shows a high percentage of broken flakes in the large and medium categories. This suggests tool production was the focus of andesite reduction. Additionally, the small and very small size categories, suggest tool maintenance occurred. Together, it appears as if tool were being produced from a worked core and then sharpened.

Table 6.16 MSRT summary for Area H, andesite cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	4 (23.5%)	0 (0.0%)	11 (64.7%)	2 (11.8%)	0 (0.0%)
Small	2 (13.3%)	0 (0.0%)	12 (80.0%)	0 (0.0%)	1 (6.7%)
Medium	3 (75.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
Large	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

The banded chalcedony cluster has a total of 10 flakes. No cortex is found on any flake and there are a total of two complex platforms. Size classes include one flake in SC1, seven flakes in SC2, and one flake in SC3. One modified flake was also identified within this cluster. With the representation of complex platforms, the small size of flakes, and the presence of modification, it is likely biface maintenance occurred here.

There are a total of six brown quartzite flakes in this cluster. No cortex is found on any flake and the single complete flake found has 2 flake scars. There are a total of 2 simple platforms, and size classes include three flakes in SC2, one flake in SC4, one flake in SC6, and one flake in SC7. With the presence of medium and large flake sizes as well as simple platforms, it is likely flake production on medium sized cores was the focus of the flaking episode of brown quartzite.

The grey quartzite cluster has a low sample size of seven flakes and looks similar to the treatment of brown quartzite in this subarea. No flakes have cortex and size classes range from one flake each in SC2 and 3, two flakes in SC4, and three flakes in SC5. The single platform identified is simple. The absence of cortex and the presence of medium sized flakes and simple platforms suggests tool production from small to medium sized cores.

The grey basalt cluster has a total of 19 flakes. No flakes have any cortex and all 11 platforms identified are simple. Of the three complete flakes found, two flakes have 2 dorsal scars and one flake has 3 scars. Size classes include one flake in SC1, six flakes in SC2, four flakes in SC3, three flakes in SC4, one flake in SC5, two flakes in SC6, one flake in SC7, and one flake in SC10. The domination of simple platforms and representation of medium and large flake size classes suggest core reduction occurred however the absence of cortex indicates the cores were previously worked.

The grey chalcedony cluster contains 18 flakes. No cortex is found on any flake and the single complete flake has 1 dorsal flake scar. There are a total of two complex platforms and six simple platforms identified in this cluster. Size classes range from two flakes in SC1, 13 flakes in SC2, and two flakes in SC5. The addition of a medium flake size class as well as strong representation of simple platforms suggests there is both biface and tool maintenance occurring on this material type in this subarea.

This cluster contains a total of 68 grey chert flakes. A single flake was found to have more than 50% cortex coverage on its dorsal surface. Of the 14 complete flakes three have 1 dorsal scar, nine have 2 scars, one has 3 scars, and one has 4 scars. There are a total of four complex platforms, and 32 simple platforms identified. With the presence of some cortex and domination of simple platforms, the attributes suggest some secondary core reduction occurred. The MSRT data shows a high percentage of complete flake sin the medium size category supporting the conclusion that small core reduction occurred. Both the small and very small categories have flake distribution that suggest tool production was the focus of this grey chert reduction. Together both the attribute analysis and the MSRT data show that small core reduction occurred with the purpose of producing tools.

Table 6.17 MSRT summary for Area H, grey chert cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	16 (33.3%)	9 (18.8%)	23 (47.9%)	0 (0.0%)	0 (0.0%)
Small	7 (36.8%)	4 (21.1%)	8 (42.1%)	0 (0.0%)	0 (0.0%)
Medium	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

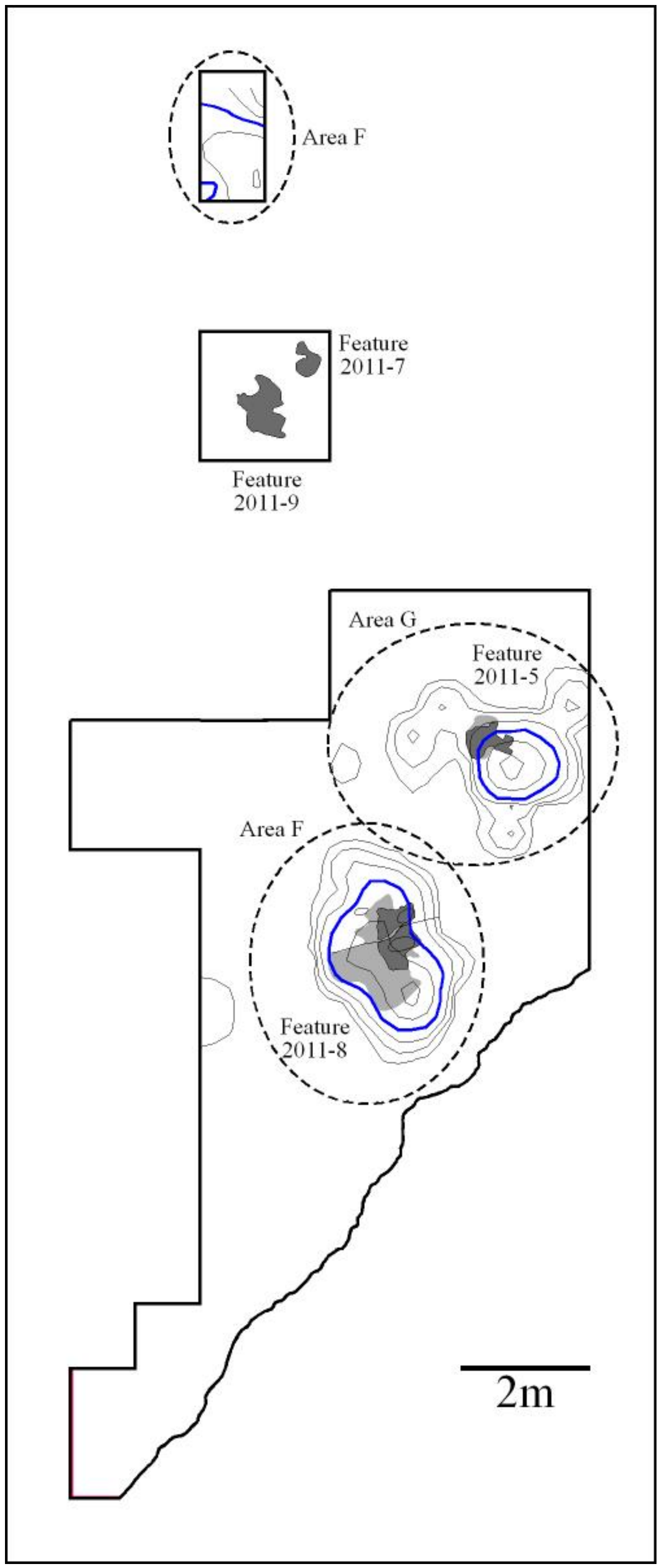

Figure 6.14 CZ3b isopleth map with cluster boundaries and Features 2011-5,7,8,9

6.4.5 CZ4

This cultural occupation has a total of three areas, five subareas, and 13 discrete clusters. A total of two hearths are also associated with CZ4.

Area I

A single subarea was defined for Area I. Subarea I1 is located in Block 106 and is associated with hearth feature 2011-10. This subarea is mostly dominated by bone artifacts and fire-cracked rocks however there is a single cluster consisting of 14 grey chert flakes. There are a total of three complete flakes, two of which have a total of 2 dorsal flake scars, and one that has 3 flake scars. No cortex was found on any flake. Platforms identified total two complex and nine simple platforms. Size classes range from two flakes as SC1, nine flakes in SC2, and three flakes in SC3. The small flake sizes, lack of cortex, as well as the presence of a few complex platforms, suggests tool and biface maintenance occurred.

Area J

Area J contains a total of three subareas. Raw materials in this area include quartz, grey chalcedony, obsidian, grey basalt, red/grey siltstone, and andesite. This area contains a large amount of variability considering it has the only obsidian cluster in the entire site as well as primary reduction of quartz. The implications are discussed below.

Subarea J1: This subarea is located in Block 101. There are total of six clusters including andesite (n=18), grey basalt (n=7), grey chalcedony (n=24), obsidian (n=5), red/grey siltstone (n=8), and quartz (n=136).

The andesite cluster consists of 18 flakes. A single artifact in this cluster is identified as shatter. There was no cortex and no complete flakes found in this cluster however four simple platforms were identified. Size classes range from one flake in SC1, 14 flake sin SC2, two flakes in SC3, and one flake in SC5. The small to medium size classes as well as simple platforms and presence of shatter suggest secondary core reduction occurred in this cluster of andesite.

The grey basalt cluster has a total of seven flakes. No cortex and no complete flakes were found in this cluster however three simple platforms were identified. Size classes range from four flakes in SC2, and one flake each in SC3, 6, and 8. The presence of medium and large flake sizes as well as simple platforms and the absence of cortex suggests secondary stage core reduction occurred on this grey basalt in this subarea.

There are a total of 24 grey chalcedony flakes in this cluster. No cortex was found on any flakes. Of the 13 complete flakes, a single flakes has 1 dorsal scar, four flakes have 2 scars, five flakes have 3 scars, two flakes have 4 scars, and one flake has over 4 flake scars. There are a total of two complex platforms and 14 simple platforms. Size class distribution ranges from three flakes in SC1, 15 flakes in SC2, four flakes in SC3, and one flake in SC4. There is also a single modified flake in this assemblage. The distribution of size classes and platform types as well as the lack of cortex and presence of modification suggests tool and biface maintenance were the focus of this reduction episode.

There is a single cluster consisting of five obsidian flakes in this subarea which represent the only obsidian cluster in the entire site. There is no cortex present and the single complete flake identified has over 4 dorsal flake scars. Size classes include one flake in SC1, 1 flake in SC2, and three flakes in SC3. There are a total of two simple platforms. The lack of modification, as well as the size classes of the flakes, and dorsal scar count suggests that this obsidian flaking episode may have been on an early stage biface or obsidian blank.

There are a total of eight artifacts in the red/grey siltstone cluster. Only one piece of this material in this cluster was found to be a flake, with a simple platform. The remaining seven artifacts are categorized as shatter. Size classes are limited to SC1 and SC2. The high percent of shatter in this case does not indicate core reduction but most likely indicate poor fracture mechanics of the material. It is likely that the single flake was broken off a tool and in doing so, several attempts resulting in shatter occurred during the reduction episode.

The largest cluster in this subarea consists of 136 quartz flakes. Four flakes have less than 50% cortex, five have more than 50% and three have 100% cortex coverage. Of the 24 complete flakes 14 have 1 dorsal flake scar, eight have 2 flake scars, and two flakes have 3 scars. All 43 of the platforms identified are simple. The attributes indicate core reduction occurred. This is also indicated by the MSRT data. The distribution of flakes in the MSRT categories shows an absence of large flake sizes indicating medium sized cores were being reduced. The high percent of broken and complete flakes in both the medium and small size categories suggests tool production was the focus of the core reduction occurring in this reduction episode.

Table 6.18 MSRT summary for Subarea J1, quartz cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	9 (8.6%)	16 (15.2%)	80 (76.2%)	0 (0.0%)	0 (0.0%)
Small	7 (30.4%)	6 (26.1%)	9 (39.1%)	1 (4.3%)	0 (0.0%)
Medium	4 (50.0%)	2 (25.0%)	1 (12.5%)	1 (12.5%)	0 (0.0%)

Subarea J2: This subarea is located in Block E52 and 102. It consists of a single large cluster of 601 quartz flakes and four quartz cores. A total of 18 flakes have less than 50% cortex, 13 flakes have more than 50% cortex and 57 flakes have 100% cortex coverage. Of the 47 complete flakes three have no dorsal scars, 18 have 1 scar, 23 have 2 scars, and three flakes have 3 dorsal scars. Of the 114 platforms identified, 90 platforms are simple, while 24 platforms were categorized as cortical. MSRT data shows an even distribution of broken flakes and complete flakes and a high number of fragments as well as representations of shatter. All together both the attribute analysis and MSRT data show that primary core reduction of quartz was the main focus in this subarea.

Table 6.19 MSRT summary for Subarea J2, quartz cluster

MSRT size	Broken	Complete	Frag	Shatter	Split
Very small	20 (6.3%)	25 (7.9%)	253 (80.3%)	17 (5.4%)	0 (0.0%)
Small	30 (13.8%)	10 (4.6%)	162 (74.3%)	15 (6.9%)	1 (0.5%)
Medium	10 (18.9%)	10 (18.9%)	29 (54.7%)	3 (5.7%)	1 (1.9%)
Large	1 (12.5%)	1 (12.5%)	5 (62.5%)	1 (12.5%)	0 (0.0%)

Figure 6.15 Block E52 CZ4 quartzite scatter

*Subarea J3: i*s located in Block E38 and has a single cluster of andesite consisting of eight flakes total. No cortex and no complete flakes were found. A total of three platforms were identified as simple. Size classes range from three flakes in SC2, three flakes in SC3, one flake in SC4, and one flake in SC5. The range of small to medium size classes as well as the lack of cortex and simple platforms suggests secondary core reduction of the andesite in this subarea.

In summary, Area J contains three distinct lithic subareas one directly associated with Feature 2011-6. Both grey basalt and andesite were reduced as secondary cores for the purpose of producing flakes. Red/grey siltstone artifacts represent a single flake being detached from a core. Grey chalcedony was exclusively utilized for tool maintenance, while obsidian flake were reduced during an earlier stage of the tool maintenance process. The most central activity of this area though is the primary reduction of quartz with some secondary reduction occurring as well.

Area K: This area is a diffuse scatter of materials encompassing blocks 105, 104, E40, E32, E26, E17, E16, and E13. There are no individual subareas in Area K however there are a total of three clusters consisting of grey chalcedony (n=6), grey chert (n=16), and quartz (n=10).

The grey chalcedony cluster has a total of six flakes. No cortex is found and the single complete flake has 2 dorsal flake scars. There are a total of three simple platforms. Size classes range from one flake in SC1, two flakes in SC2, 2 flakes in SC3, and 1 flake in SC4. Lack of cortex and flake size as well as simple platforms suggests tool maintenance occurred.

The grey chert cluster contains 16 flakes. No cortex is found and there are a total of five simple platforms. Of the two complete flakes found one flake has 3 dorsal scars and one flake has 4 scars. Size classes range from three flakes in SC1, 12 flakes in SC2, and 1 flake in SC3. The dorsal scar count and flake size indicate biface maintenance occurred .

There are a total of 10 quartz flakes in this cluster. No cortex was found on any flake however, one platform was categorized as cortical with the other four platforms identified as simple. Of the three complete flakes two have 1 dorsal scar and one has 3 flake scars. Size classes range from five flakes in SC2, one flake in SC3, one flake in SC7, one flake in SC13, one flake in SC15, and one flake in SC25. The large and medium size classes as well as distribution of simple and cortical platforms suggest both primary and secondary core reduction occurred on quartz in this area.

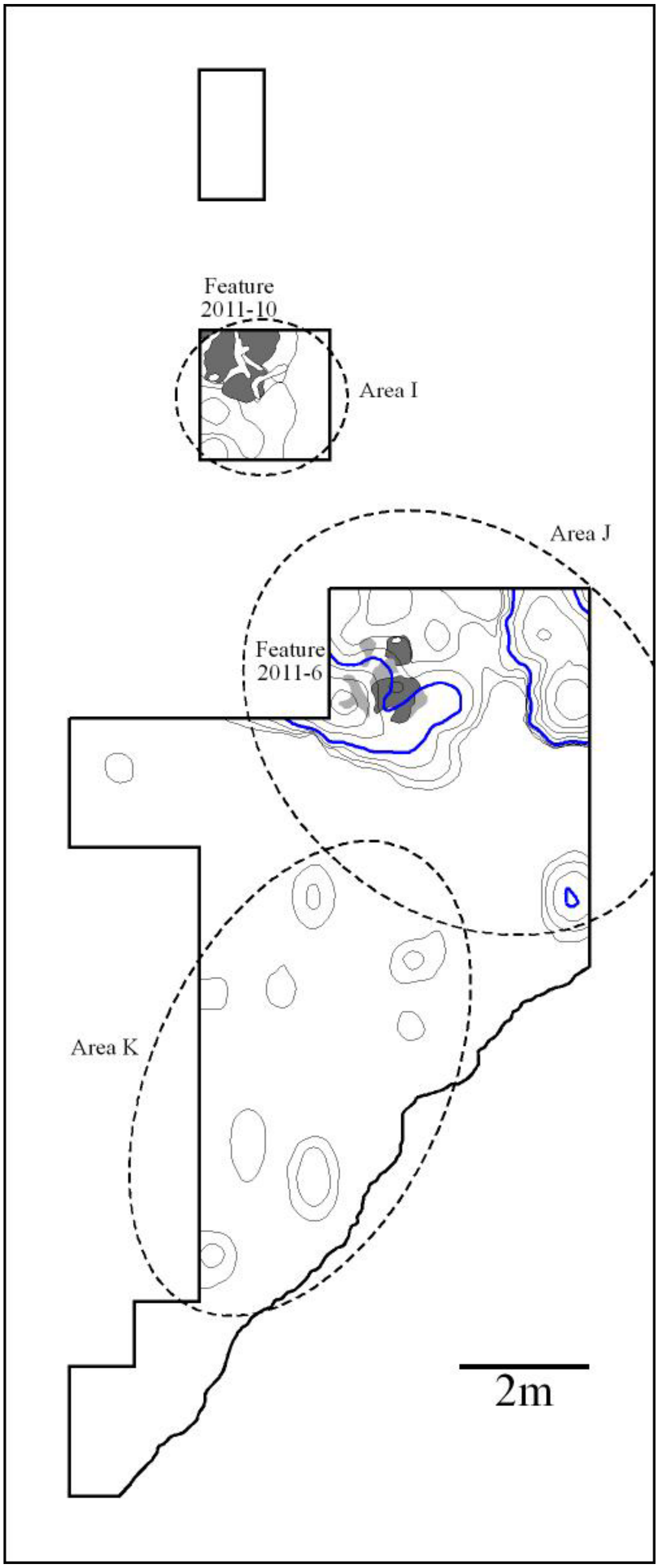

Figure 6.16 CZ4 isopleth map with cluster borders and features 2011-6, 10

6.4.6 Comparisons

At the component-level analysis a notable difference in spatial patterning stands out, CZ1b has a much more even distribution of materials throughout the site. CZ2, CZ3b, and CZ4 all have clearly-defined boundaries for lithic areas in the site. While this is not represented well through artifact density (see Table 6.20), it can visually be seen in the isopleth maps of each component (Figure 6.12, Figure 6.13, Figure 6.14, Figure 6.16).

For the subareas at the site, overall there is little to no diversity and subareas are generally uneven when calculating the Simpson and Shannon-Weaver indices for flakes, tools, and cores. This is expected given the low frequency of tools throughout the site. Area K (or subaraea K1), a large area with no dense concentration of artifacts, has the highest diversity for this index and is the most even out of all the subareas however it only represents medium diversity and medium evenness when compared to limits for the indices (see Table 6.21).

Table 6.20 Artifact densities by CZ

CZ	Analytical Area (m2)	N flakes	Total weight (g)	Flake Density (n flakes/m2)	Weight density (g/m2)
CZ1b	72	3968	4396.80	55.11	61.07
CZ2	22	1942	55.16	88.27	2.51
CZ3a	2	13	3.07	6.50	1.54
CZ4	29	941	3178.48	32.45	109.60

Out of the 16 different raw materials identified at the site, a total of 10 raw materials types were frequent enough to show up in multiple subareas: andesite, banded chalcedony, black chert, brown quartzite, grey basalt, grey quartzite, grey chalcedony, grey chert, rhyolite, and quartz. Because of the low frequency of raw material types, Simpson and Shannon-Weaver indices tend to show only medium diversity in each subarea, however subareas C1, H1, and K1, all have Simpson indices over 0.6, indicating diversity and evenness on a higher scale than the rest of the subareas (see Table 6.22).

Table 6.21 Shannon-Weaver and Simpson index for flakes, tools, and cores by subarea

Subarea	Total	Debitage	Tools	Cores	Shannon-Weaver Diversity Index (H')	Simpson Index of Evenness(1-D)
A1	1479	1468	11	0	0.0439	0.0148
B1	118	117	1	0	0.0489	0.0169
B2	27	27	0	0	0.0000	0.0000
B3	203	201	2	0	0.0553	0.0196
B4	954	945	9	0	0.0534	0.0187
C1	760	757	0	3	0.0258	0.0079
C2	23	23	0	0	0.0000	0.0000
D1	1074	1070	4	0	0.0245	0.0074
E1	864	861	3	0	0.0231	0.0069
F1	122	120	2	0	0.0836	0.0325
G1	100	97	2	1	0.1538	0.0592
H1	167	165	2	0	0.0649	0.0238
I1	18	18	0	0	0.0000	0.0000
K1	40	34	6	0	0.4227	0.2615
J1	202	201	1	0	0.0312	0.0099
J2	605	598	3	4	0.0710	0.0230
J3	13	13	0	0	0.0000	0.0000

The high indices in Area K are likely due to the fact that it is a diffuse scatter of material in CZ4. The high diversity of raw material types and low density (Table 6.23) of artifacts indicates that this area most likely does not represent a single activity area. This suggests that occupants probably did not intentionally stop to reduce material here but rather preferred reducing in designated areas, leaving this area relatively clear for other activities such as butchering and food processing. Subarea C1 is also a diffuse scatter, but is located in CZ1b. Again, the low density of material and high diversity of material types over a broad area suggests that this was not a marked activity area, but was rather an “in-between” area where reduction occurring haphazardly rather than deliberately. While the high diversity of materials is subareas

K1 and C1 can be attributed to the size of the scatter, Area H, or subarea H1, is very different. Area H is located in CZ3b and is directly associated with a large hearth feature, 2011-8. The size of the hearth, as well as the frequency of both bone and toolstone, and the high diversity of raw material types, suggests this was a central hearth in this occupation. It is reasonable to infer multiple people were centered on this hearth during its use and it functioned as a central activity area for both cooking and lithic reduction.

Table 6.22 Shannon-Weaver and Simpson index for raw material by CZ and subarea

CZ	Subarea	Number of lithics	Number of raw materials	Shannon-Weaver Diversity Index (H')	Simpson Index of Evenness(1-D)
CZ1b	B3	203	3	0.108	0.039
	B2	27	4	0.4709	0.2137
	C2	23	4	0.5305	0.249
	A1	1479	6	0.4768	0.2578
	B1	118	5	0.6069	0.288
	B4	954	14	0.8601	0.5043
	C1	760	8	1.2553	0.6756
CZ2	E1	864	7	0.1709	0.0589
	D1	1074	11	0.314	0.1079
CZ3b	G1	100	7	0.6864	0.2905
	F1	122	8	1.1697	0.5734
	H1	167	8	1.6612	0.7583
CZ4	J2	605	4	0.0466	0.0132
	I1	18	3	0.6547	0.3856
	J1	202	8	1.1596	0.5236
	J3	13	3	0.8587	0.5641
	K1	40	5	1.3441	0.7247

Besides diversity and density, spatial analysis shows general trends of redundancy throughout the occupations as well which can reflect on occupation length and social structure. Heterogeneous spatial patterning, seen through multiple types of features specific dedicated activities to different areas of the site shows prolonged occupation. In contrast, short term camps show a narrow range of activities (Bamforth 1991).

Table 6.23 Artifact densities by CZ and subarea

CZ	Subarea	Analytical Area (m2)	N flakes	Total weight (g)	Flake Density (n flakes/m2)	Weight density (g/m2)
CZ1b	A1	4	1477	329.79	369.25	82.45
	B1	3	118	454.5	39.33	151.5
	B2	3	27	34.69	9	11.56
	B3	2	203	35.31	101.5	17.66
	B4	8	954	132.36	119.25	16.55
	C1	10	760	2951.82	76	295.18
	C2	1	23	6.12	23	6.12
CZ2	D1	14	1074	218.1	76.71	15.58
	E1	4	864	336.03	216	84.01
CZ3b	F1	3	122	13.31	40.67	4.44
	G1	4	100	224.29	25	56.07
	H1	6	167	123.8	27.83	20.63
CZ4	I1	4	18	0.63	4.5	0.16
	K1	13	38	462.94	2.92	35.61
	J1	4	202	79.67	50.5	19.92
	J2	5	605	2578.5	121	515.7
	J3	1	13	3.44	13	3.44

Defining a component as short term or long term has implications concerning mobility, and therefore seasonality, site function, and even group size. CZ1b contains a large cache pit feature, and lithic reduction is generally limited to core reduction, biface manufacture and maintenance. Subareas are relatively homogeneous in types of activities occurring. The redundancy seems to suggest short term occupation however evidence of food storage, high diversity of tool forms and other data suggest CZ1b is long term. CZ2 is clearly specialized, with biface manufacture and core reduction representing the majority of reduction. While the subarea boundaries are clearly defined, activities with each are very similar, indicating short term occupation. In CZ3b, heterogeneous spatial patterning indicates longer term occupation, for this reason, as well as other supporting data, CZ3b was determined not to be a short term, hunting camp but rather an extractive location where occupant likely remained for an extended stay, but did not utilize the site as a base camp. This is a similar conclusion for CZ4. The variability seen between hearth locations, as well as between specific reduction occurring in clusters and subareas is not redundant implying that CZ4 was long term, however a larger body of lithic evidence, such as raw material use, suggests that long term does not mean base camp, but rather an extractive location. Implications of the spatial patterning with reference to broader behavioral patterns are discussed further in the following chapters.

Chapter 7 Technological Strategies and Use of the Site

This chapter includes a discussion of the technological strategies and site type characterization for each cultural occupation. CZ3a is excluded due to small sample size. In order to begin describing a site in this way, certain assumptions about how differences in mobility, raw material procurement and occupation lengths should affect the lithic assemblage must be stated.

7.1 CZ1b

If diversity of tool forms and preference for local material is an accurate way to distinguish long term and short term camps, then the lithics in CZ1b indicate a long term residential base camp (Table 7.1). This is based from the idea that as a stay is prolonged, more tools will be discarded and replaced, which will not only increase the number of tools, but the number of classifications of tools. Evidence of this is seen in the heavy use of local materials both in debitage and modified flakes and the larger variety in formal tool types than any other occupation. Further evidence of CZ1b functioning as a base camp is shown by the cache pit feature. The storage feature is consistent with logistically organized societies where base camps were occupied for longer periods of time than expected for foraging base camps. It is clear that some materials are being obtained directly such as obsidian and possibly the chalcedonies, while others such as the grey chert are being obtained as part of an embedded system where they are collected during other daily activities. Tools found in this component in general do not show substantial damage or maximization with the exception of two heavily curated scrapers. This suggests that curation was not an important strategy when present at the site most likely due to the abundance of local chert. It follows that expedient technology, defined here as a strategy where tools are made when they are needed and discarded shortly afterwards, is the central strategy for producing tools for the people occupying the site.

Patterns of flaking do suggest that biface manufacture occurred in this occupation however no bifaces are found at the site. It is reasonable to assume that bifaces were being removed off-site possibly for hunting purposes. The fact that no hunting weapons are found in CZ1b further implicates this occupation as a base camp, where hunting activities took place elsewhere and large game was brought back to the camp for processing and cooking while small game could have been taken from a local foraging zone. The overall technological strategy shows local chert brought in as cobbles or blanks, and reduced for the production of flakes and bifaces for immediate use. Tool forms with longer use-lives, which were not exhausted at the site, were carried to other camps. The brown quartzite found on-site is likely not being reduced for use but rather being tested for toolstone qualities. This is evident in the total lack of modified flakes made from the material as well as the high rate of heat treatment possibly indicating an effort to improve the quality of material for potential use. The mobile toolkit brought into the site consists of obsidian and chalcedony tools, with some basalt and black chert early stage tools or blanks. Lithic patterns in CZ1b do not indicate that there was any resource stress when present at the site however it is possible, due to the two heavily curated scarpers, that lithic material is scarce at other seasonal camps utilized by the occupants of CZ1b.

Table 7.1 Shannon-Weaver and Simpson index for tool classes by CZ

CZ	Number of Formal Tools	Tool Classes	Shannon-Weaver Diversity Index (H')	Simpson Index of Evenness(1-D)
1b	6	4	1.3297	0.8667
2	4	2	0.3466	0.5000
3a	0	0	0.0000	1.0000
3b	1	1	0.0000	1.0000
4	3	2	0.6365	0.6667

7.2 CZ2

CZ2 has very different patterns of technological and spatial organization than all other components. The majority of reduction occurring in CZ2 is focused on biface manufacture, in general very few modified flakes are found resulting in the tool assemblage having a high percentage of bifaces, especially when data from 2012 is taken into account. Like CZ1b, CZ2 is dominated by local materials however the low diversity of tool forms indicates specialization. The formal tools that are found, namely the three grey chert bifaces, are not heavily curated and there is no evidence of maximization. Together with the debitage flaking patterns indicating grey chert core reduction, evidence suggests that the bifaces were manufactured on-site using local materials. The absence of bifaces discarded due to impact fractures shows that bifaces were not used as hunting weapons at the site. This suggests that large game hunting did not occur in this occupation in this location. It is reasonable to assume that some manufactured bifaces were taken off site to be used elsewhere as hunting implements, although the biface could have been implemented as knifes and deposited in an unexcavated area of the site. Spike camps meant for hunting in a logistically organized system would likely have had preforms made en masse to prepare for the hunting activities. The evidence in CZ2 is consistent with this pattern and is therefore interpreted as a logistic spike camp.

These patterns that support the use of the site as a logistic spike camp become even more apparent with the addition of 2012 data where several preforms broken during manufacture are included in the CZ2 assemblage. This specialization in biface manufacture not only indicates site type, but also suggests an increase in risk for the people who occupied the site at this time following the assumption that as the risk of failure increases, a toolkit will become more specialized (Torrence 1989). This is also supported by Nelson (1996:111) who states that "specialization and diversification" are strategies employed to cope with risk. "Risk" here is probably referring to food resource risk rather than risk associated with toolstone given the discard of lightly used bifaces and the reduction of local chert cobbles. Following Esdale's (2009:380) modified seasonal tool production and use model CZ2 would likely be a summer occupation where biface production was the focus, microblade production was absent, and toolstone was abundant. CZ2 probably does not represent "gearing up" because a necessary element of this process of the replacement of used tools. The complete lack of late stage tools of any kind in CZ2 indicates that the biface manufacture occurring was not gearing up, but rather part of a system of raw material collection.

7.3 CZ3b

This cultural component marks a noted shift in patterns from the upper Cultural Zones, CZ1b and CZ22. CZ3b lithics indicate this occupation was part of a residentially mobile system where groups moved more frequently than in the mid Holocene. The complete lack of diversity in tools types found in this component suggests short term occupation. Following normal convention, a short term occupation would reflect low frequency of local materials. However in CZ3b this is not the case. The debitage is dominated by local material, namely the grey chert found abundantly throughout the site. However the modified flakes are almost entirely nonlocal material, in this case, the grey and banded chalcedonies. This would suggest that while local materials are being reduced, tools and blanks that were carried to the site are being maintained. However the lack of discarded formal tools implies that the local chert was not being reduced with the intention of replacing formal tools, and the lack of grey chert modified flakes suggests the material was not being used to produce expedient tools. Instead, this would seem to indicate that the grey chert is being reduced into blanks or prepared cores to maximize efficiency for addition into the mobile toolkit of the occupants.

While the lithic reduction occurring in CZ3b seems to represent a short term occupation the spatial patterning seems to represent a longer term occupation. Diverse spatial patterning including multiple types of features and areas with specific uses within a site shows extended occupation. Short term camps generally exhibit very little variation in the activities performed at a site (Bamforth 1991). In CZ3b a stark contrast exists between the features present, most importantly the lack of lithics near 2011-9 and the abundance of flakes near 2011-5 and 2011-8. This dissimilarity, or low redundancy, suggests different uses or activities associated with the features indicating diverse spatial patterning. This is also seen through detailed analysis of lithic clusters in CZ3b with the overall pattern being that area and subareas are varied. The spatial patterning then seems to suggest that CZ3b is a long term occupation. This is supported by a high diversity of raw materials, also seen as an indication occupation length was longer. The contrasting data, formal tool forms for short occupation, and spatial variation and raw materials for long term occupation, could be due to a number of reasons. Sample size may account for the lack of formal tool forms so it could be that the formal tools simply have not yet been excavated at the site. Another possible reason is that CZ3b is a palimpsest of material not identified in cultural component delineation. Evidence for this is seen in non-contemporaneous hearth dates in 2012, as well as through new stratigraphic information form 2012 that suggests CZ3b reflects two occupations, CZ3b1 and CZ3b2. A palimpsest of occupations could account for the conflicting signals found in CZ3b. Tentatively, this occupation represent a “location” within a residentially mobile foraging system (Binford 1980), although this could differ dramatically if and when the assemblage is properly split into two cultural zones.

7.4 CZ4

The lowest and earliest cultural zone at Mead is somewhat similar to CZ3b. CZ4 also contains two hearths that have very different signatures from each other indicating that this component may also represent an extended occupation. Hearth Feature 2011-6 is associated with a mixture of both bones and multiple clusters of lithic reduction while hearth Feature 2011-10 is almost entirely lacks lithic reduction but is associated with many bone fragments as well as fire-cracked rocks. The lack of lithics near feature 2011-10 indicates the activities surrounding this hearth were different than the activities surrounding 2011-6, mostly likely a difference between a specialized cooking hearth and a more generic hearth meant for warmth and light. The different signals represent specialized areas of the site that had assigned activities prescribed to them, which is a pattern expected of occupants who are staying on a longer time frame than if at an ephemeral hunting camp.

For the lithics, CZ4 has a medium diversity of tool form but a low diversity index of raw materials. If a high number of tool forms and a high variety of raw materials are expected when site occupation is long, then the CZ4 lithics suggest a shorter occupation. This is supported by a high rate of curation found on chalcedony tools, a signal that indicates the occupants were conserving valued material at the site rather than replacing them. A high frequency of nonlocal material is also expected for short term sites, while this pattern is seen in the modified flakes and tools of CZ4, the debitage assemblage is dominated by local material. This is due to the primary reduction of quartz occurring on-site. The idea that a long term site is dominated by local material is based on the idea that as people stay in one place, embedded procurement of local sources within a 20km round trip should increase. At Mead, the quartz was immediately available and therefore even a single occupation spanning a week could create a massive amount of local debitage without the need for gathering of other local sources. In this case, the quartz reduction at the site represents opportunistic reduction rather than patterns expected with long term sites. It should be noted that the ideas of long term and short term could be the difference of a few weeks or even days in this context. CZ4 is therefore still generally showing patterns of short term site leaning towards a longer occupation length on the short term spectrum. In sum, evidence shows that according to the lithic information, CZ4 functioned as an extractive location within a residentially mobile system, where occupants set up camp in order to take advantage of the quartz material found at the site. Chalcedony tools and at least one obsidian blank were brought to site as part of a mobile toolkit and were maintained during their stay. Tools were not replaced with the quartz, likely due to the difference in the quality of the material.

Chapter 8 Discussion

The analysis at Mead is part of a large body of existing and current research about archaeological sites in Alaska (Goebel and Buvit 2011; West 1996). While excavations and analysis at nearby sites have been conducted, comparable analysis involving debitage analysis and behavioral inferences is scarce. Notably, Swan Point and Broken Mammoth are both well-known sites located near the Mead site. However analysis of these sites has typically focused on techno-typological assignments and tool forms rather than debitage and behavioral patterns (Holmes 1996, 1998, 2011; Holmes et al. 1996; Yesner et al. 1992). Some comparisons can be made, such as at Broken Mammoth. The faunal assemblage from the earliest cultural zone at Broken Mammoth is indicative of broad spectrum foraging (Yesner 1996). Preliminary understanding of the Mead faunal assemblage from the time also shows signs of broad spectrum foraging, indicating both Broken Mammoth and Mead occupants were taking advantage of a variety of animals as a part of their subsistence system. Additionally a large workshop area for the purpose of reducing ventifacted quartz cobbles was found both at Mead as well as Broken Mammoth in the earliest cultural components. Detailed debitage analysis of the Broken Mammoth and Swan Point assemblages focused on identifying behavior is necessary to make relevant comparisons between the sites.

The Gerstle River site is located in the Tanana Valley and extensive lithic and spatial analysis has been carried out, allowing for a direct comparison with the findings from Mead. Component 3 at Gerstle River, comparable with CZ3b at Mead, contains evidence of biface reduction with patterns expected of logistically organized hunting behavior including presence of weapons repair kits. This component is associated with expedient faunal processing and demonstrates a narrow range of behaviors, further indicating the site was used as a hunting camp. At Mead, the late Pleistocene and early Holocene components show signs of residentially mobile groups, where occupation is longer than seen at Gerstle. There is a total absence of hunting tools, and spatial analysis indicates behaviors were varied, providing evidence that Mead did not function as a hunting camp at this time. Additionally, the Gerstle faunal data shows focused intent on large game resources, while the faunal data at Mead suggests broad spectrum hunting with the inclusion of small mammals and birds, in addition to large game. This again highlights the different purposes of the site, and the patterns that can be seen from them. Some behavioral similarities do occur between the sites, patterns at both Gerstle and Mead show that the occupants were not under any stress for lithic resources. This may suggest that late Pleistocene/early Holocene groups were knowledgeable about the location of lithic material sources in the Tanana Valley, although this requires further testing before stated with confidence. Other comparable analysis in the Tanana Valley includes the research conducted on the Dry Creek site. Most notably, Component 2 at Dry Creek, comparable with Mead CZ3b, contains 1,772 microblades, and like Gerstle, shows evidence of focus on large game hunting (Powers 1983). Based on heavy frequencies of hunting technology and spatial patterns, Dry Creek components 1 and 2 have been labeled as spike camps (Guthrie 1983). The earlier components at Mead have been labeled as extractive locations based on the lithic evidence, in comparison with Dry creek occupants at Mead were focused on a utilizing a broader range of resources, possibly indicating differences in seasonal occupation.

Other than site-to-site comparisons, some work has been conducted on characterizing broad behavioral patterns. Two of these groups that are temporally comparable with occupations at Mead are the Paleoindian period (late Pleistocene/early Holocene) and the Northern Archaic (middle Holocene). Paleoindian behaviors can be expected to occur in the time frames of CZ3b and CZ4 at Mead. Overarching observed behaviors include mobility, Paleoindian people likely employed a residentially mobile system where groups moved from “kill to kill” and there would have been an “immediate search for further resources” following a kill (Kelly and Todd 1988:236, 238). The high frequency of residential moves would have left little time for intensive processing and patterns associated with this behavior are not expected at terminal Pleistocene sites. Because Paleoindians used their landscape in a short term fashion, sites should be “relatively undifferentiated within a region” leading to inter-site redundancy. Other measurable effects of the high mobility would be the need for highly transportable technology, mostly likely good toolstone quality bifaces and a marked lack of storage(Kelly and Todd 1988). Sites are expected to be diverse with a wide range of activities evident at one site. This is consistent with patterns at the Mead site, although CZ3b and CZ4 have been deemed extractive locations this does not mean that resources extraction was the only activity to have occurred there, this is shown in the variety of uses of hearths, variability in lithic clusters, and wide range of game present at the site. Yesner (1996) suggests that bluff top sites in the late Pleistocene were part of a seasonal round focused on the exploitation of both large game and waterfowl. Although more faunal analysis needs to be conducted at Mead, the data support this conclusion (Potter et al. 2013). Broader behavioral expectations include the notion that multiple household units were present at each site. Considering the distance between hearths in the earlier components at Mead, this likely applies. Mead does differ from some expectations however. Bever (2012:30) suggests that the early Holcocene would have been a time of resource stress where material conserving activities such as microblade production and bipolar reduction would have been employed, however these patterns of lithic resource stress are not present at Mead. Faunal analysis from Gerstle River also shows that early Holocene populations were not under stress for large game (Potter 2005), indicating that the expectation of resource stress may be incorrect for the people in the Tanana Valley.

While CZ3b and CZ4 are encompassed in patterns expected for Paleoindian behaviors, CZ1b and possibly CZ2 are temporally associated with the Northern Archaic tradition. Expected patterns for the Northern Archaic lithic technology include a diverse toolkit where core and blade, bifacial and unifacial technology should all be present as a part of a weapons system designed to reduce risk (Esdale 2009). Embedded procurement was mostly likely the main strategy for raw material collection (Esdale 2009:373). When bifaces were found in site in the Brooks Range dating to the middle Holocene, more often than not they showed signs of heavy retouched and were impact fractured (Esdale 2009:374). This observed pattern for bifaces in the Northern Archaic is different than patterns seen in CZ1b and CZ2 at Mead, where there are discarded preforms and bifaces that show usewear, have been lightly worked, and show association with manufacture rather than hunting use. The differences here could be due to a number of things and do not necessarily mean that Mead CZ1b and CZ2 do not fit in with Northern Archaic behavioral patterns. The expected patterns for bifaces stated here comes from observations in sites in the Brooks Range, largely upland sites. Mead is a lowland site. It is possible that Mead is part of a seasonal round where no organized, large-game hunting occurred, but rather where bifaces were manufactured prior to the movement to upland sites where hunting was the focus of occupation. This would also explain the specialized toolkit seen at Mead rather than the diverse toolkit expected for the Northern Archaic. Economic patterns in the Northern Archaic show a contrast from late Pleistocene patterns. There is a notable transition to logistic mobility, and increase in cultural complexity and an increase in group size (Huckell 1996). The shift from Paleoindian to the Northern Archaic is clearly represented at Mead. There is a clear shift from foraging to collecting after the late Pleistocene/early Holocene. The components associated with Paleoindians, CZ3b and CZ4, look remarkably similar in spatial patterning and in their mobile toolkit design, indicating highly mobile people with diverse activities (low redundancy of activity areas) occurring at the site. CZ1b and CZ2, associated with the Northern Archaic, stand apart as cultural occupations by the specialization of biface manufacture and increase in formal tools diversity at the site indicating a shift in resource handling strategies as well as site-type complexity. This shift could be due to a widely observed change in the environment in the Tanana Valley between the early Holocene and the middle Holocene. Changes in frequency of game, as well as the variety and spread of vegetation shifted dramatically, which no doubt called for new adaptive strategies from the people who lived on the landscape (Bever 2012; Bigelow and Edwards 2001; Yesner 1996).

The Mead site provides significant information into the interpretation of the behaviors of past people within the region. With multiple occupations spread over a broad range of time, these analyses addressed many questions concerning adaptive strategies in the past. The research conducted in this thesis provides valuable information on the lithic strategies of past site occupants. Using a variety of analytical methods, the inferences made here can be stated with more confidence than through typological analysis of tools alone. While conclusions concerning the technological organization at the site have been made, as with any research, more questions have been raised. To what extent can changes in technological strategies be attributed environmental changes? Does the faunal record at Mead show any indication of the site being used as a hunting site that the lithic data does not represent? A refitting analysis at the site could identify the relationship between the quartz artifacts in CZ3b and 4. Further research including a detailed faunal analysis and closer inspection of spatial elements in CZ4 is underway. Although new information from ongoing excavations will add to the inferences made here, any behavioral conclusions drawn about the occupants of Mead are considered to be robust based on multiple methods of analysis and a strong theoretical background.

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Appendix A Statistical Tests for Significance Summaries

Table A-1 Chi-square statistics results

Data	Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Cortex for Rhyolite and Obsidian	Fisher's Exact Test	2.189	1	.139	.173	.173
Cortex for Rhyolite and Quartz	Pearson Chi-Square	48.180	1	.000		
Cortex for CZ3b and CZ4 flake	Pearson Chi-Square	9.809	3	.200		
Size class for Rhyolite and Obsidian	Pearson Chi-Square	5.725	7	.572		
Size class for Rhyolite and Quartz	Pearson Chi-Square	42.778	15	.000		
Modification for Rhyolite and Quartz	Fisher's Exact Test	.364	1	.546	1.000	.480
Modification% for Rhyolite and Quartz	Pearson Chi-Square	3.496	2	.174		
Modification for Obsidian and Quartz	Fisher's Exact Test	94.527	1	.000	.000	.000
Modification% for Obsidian and Quartz	Pearson Chi-Square	102.079	2	.000		
Modification for Obsidian and Rhyolite	Fisher's Exact Test	81.942	1	.000	.000	.000
Modification% for Obsidian and Rhyolite	Pearson Chi-Square	97.495	3	.000		
Shatter for Obsidian and Rhyolite	Fisher's Exact Test	.187	1	.665	1.000	.834
Shatter for Rhyolite and Quartz	Fisher's Exact Test	21.886	1	.000	.000	.000

Table A-2 Independent samples t-test statistics results

Data	F	Sig.	t	df	Sig. (2-tailed)
Core size value for CZ3b and CZ4	3.451	.137	-1.208	4	.294
Edge angle for Chalcedony in Upper and Lower components	.000	.990	-.631	14	.538
Edge angle for Grey chert in Upper and Lower components	3.453	.072	-.875	33	.388
Width for modified and unmodified flakes, CZ1b	21.337	.000	4.714	3970	.000
Length for modified and unmodified flakes, CZ1b	16.582	.000	5.068	3970	.000
Thickness for modified and unmodified flakes, CZ1b	1.180	.277	1.569	3970	.117
Weight for modified and unmodified flakes, CZ1b	20.301	.000	2.969	3970	.003
Width for modified and unmodified flakes, CZ4	.372	.542	1.760	933	.079
Length for modified and unmodified flakes, CZ4	24.544	.000	5.413	933	.000
Thickness for modified and unmodified flakes, CZ4	.565	.452	1.257	933	.209
Weight for modified and unmodified flakes, CZ4	.312	.577	.640	933	.523

Table A-3 ANOVA statistics results for dorsal scar counts

Dorsal Scar Data	Sum of Squares	df	Mean Square	F	Sig.
Rhyolite and Quartz	367.585	1	367.585	492.832	.000
Rhyolite and Obsidian	1087.273	2	543.636	1236.960	.000
Obsidian and Quartz	124.159	1	124.159	242.344	.000

Appendix B Measured Attributes

Debitage Attributes

Completeness - This attribute contains objective descriptions as set by Sullivan and Rozen (1985) that describe the intactness of the flake. This includes a complete flake, broken flake, flake fragment and shatter (referred to as debris in their original study). The term split flake was added to account for flakes broken longitudinally.

Type - The type attribute is a subjective category that aims to categorize flakes by commonly used terms similar to a technological typology approach (Andrefsky 2005:120-127). This attribute was recorded mainly for the purpose of relating to other researchers and not for heavy use in the analysis of the data. A simple flake is the basic flake type and has no special characteristics other than that it is a flake. A bifacial thinning flake for the purpose of this study must have the following attributes: a lipped platform, a complex platform, 2 or more dorsal scars, diffuse bulb, and no cortex (Andrefsky 2005; Crabtree 1972:96; Andrefsky 1986:49) A unifacial thinning flake has the same characteristics of bifacial thinning flake except for a simple instead of complex platform. Microblade debris can consists of modified or unmodified microblades. Microblades are blades that are generally twice as long as they are wide with a single or double arris on the dorsal surface oriented proximal to distal ends. A decortication flake has at least 50% of its dorsal surface covered in cortex and is generally large in size when compared to specimens of the same material (Odell 1989). An unknown type generally is not used for flakes but for pieces of shatter.

Raw Material options for the Mead site assemblage includes, chert, basalt, obsidian, quartzite, rhyolite, siltstone, chalcedony, siltstone, quartz, and jasper. In order better describe the characteristics of each type of raw material, color, luster, texture, homogeneity, and quality were recorded for each artifact. *Color* was determined using Munsell. *Luster* is described as waxy, glassy, vitreous, or dull. *Texture* subjectively describes the grain size of the material and divides them into four options: fine, medium, coarse, very coarse. *Homogeneity* accounts for any inclusion visible in the material other than color variability and divides them into three options of homogeneous, somewhat homogeneous, and heterogeneous. *Quality* is a subjective category designed to roughly describe the overall characteristics of the material for use in manufacture. Quality can be excellent, fair, or poor.

Cortex - The recording of the amount of cortex has been shown to be useful in determining in what stage of reduction a flake may have been manufactured (Andrefsky 2005: 115) although there are many problems with consistency of application between researchers (Rozen and Sullivan 1989:757). For this project cortex was categorized into 5 levels, 0%, 1<49%, >50<99%, and 100%. Although no separate category was created there are both primary source and secondary source cortex in this assemblage. Secondary source cortex occurs only on the quartz in the form of a ventifacted surface. When present it was noted, all other cortex recorded in this assemblage refers to primary source cortex.

Platform - The striking platform type can be useful in determining at what stage of reduction the flake was produced and the percussion type used to remove the flake. A platform may be absent if the flake is incomplete and has been broken. Other types include simple, complex, cortical, prepared, and abraided. For this project simple platform are defines as having a single facet while complex platforms have two or more facets.

Dorsal Scar Count - Dorsal scars are counted and recorded from 0, 1, 2, 3, 4 and >4. Zero is only used in the case of flakes that have 100% cortex. Scars were counted only if they were clearly visible on the dorsal surface rather than the edge of the flake in order to remove the presence of use wear flake scars from the total count.

Termination – Flake termination records the type of distal margin on a flake and is a useful variable in determining amount of force. Types include feathered, plunging or overshot, hinge, or step. A feathered termination is recognized by a smooth tapered distal end. A plunging termination, also referred to as an overshot termination, is a result of the applied force rolling into the objective piece the flake was detached from. This type of termination will often have a large portion of the objective piece intact on the flake near the distal end. A hinge termination can be recognized by a smooth, rolled distal end where the force applied to the flake rolled away from the objective piece. A step termination is recognized by a sharp angle at the distal end of the flake resulting from an abrupt change in the direction of the applied force during the manufacturing process.

Thermal Alteration was recorded in two categories that document evidence of heat treatment. Thermal alteration 1 simply records the presence or absence of such evidence while thermal alteration 2 records the type of evidence including pot lidding, crazing, color change, or fracturing.

Edge Damage, eraillure scar, lipping, and *bulb of force* are all attributes where only the presence or absence was recorded. All debris should have absent edge damage. Eraillure scar records the presence or absence of the small flake often chipped away during manufacture and can inform on how much pressure was applied to the removal of the flake. Lipping refers to a lipped or non-lipped platform that can help determine what kind of percussion was used. For the case of recorded the bulb of force, instead of 0 for absent and 1 for present, the terms diffuse and salient were used to better describe the kind of protrusion from the ventral surface.

Weight was measured in grams with an Ohaus Adventurer Pro AV812 digital scale.

Length, width, and *thickness* were all measure in millimeters using a Mitutoyo digital caliper. Length was measured as a maximum dimension perpendicular to the striking platform of the flake. Width was measured as a maximum dimension parallel to the striking platform. Thickness was measured as a maximum dimension, measurement were made using a similar linear point on both ventral and dorsal surfaces

<u>Modified Flake Attributes</u>

All attributes for debris were also measured and recorded for modified flakes. This includes : completeness, type, raw material, cortex, platform, dorsal scar count, termination, thermal alteration, edge damage, eraillure scar, lipping, bulb of force, weight, Length, width, and thickness.

Number of utilized margins records the total number of edges with evidence of use-wear or modification.

Number of flake margins records the total number of edges the flake contains.

Percent utilized margins are calculated by dividing the number of utilized margins over the number of flake margins. This records the percent of edged on the flake that have been used.

Edge Shape – this attribute describes the type of contour of the flake edge. Types can include notched, convex, concave, straight, or pointed.

Position – This attribute records the location of the worked edge that all following attributes were recorded for. A single specimen may have different attributes depending on which working edge is being recorded. By recording this attribute the following attributes are assigned to a specific edge on the same flake. Positions include left and right lateral edges and proximal and distal edges. Left and right is determined by holding the flake with the proximal end down and the dorsal surface facing the researcher.

Modification type includes burin-like wear such as crushing and striations parallel to the working edge, crushing, polish, microflaking, chipping, and retouch, while *Modification Type2* records the type of termination of use wear flake scars. Categories include stepped or feathered. Additionally smoothed was added as a category to describe the arises between flake scars. Smoothed modification records that the sharp ridges usually observed between flake scars have been worn down and dulled. *Modification Type3* includes two categories: continuous and clustered. These describe the spacing of the use wear along a flake edge.

Modification Intensity was subjectively recorded as either light or heavy based on characteristics including invasiveness, percent coverage, and edge angle.

Face Position describes the location of the use wear pattern on a flake edge. Categories include dorsal, ventral, both, edge.

Modification length was measured using a string to conform to the shape of the edge and then measuring the length of the string using a digital caliper. Once all modification lengths were measured for each edge on a single artifact the amounts would be totaled for a new attribute *Sum of Modification Length*.

Edge Angle was measured using a hand-held digital Baseline goniometer. This attribute is useful in measuring the extent of curation and stage life of an artifact.

Biface Attributes

The attributes *raw material*, *color*, *luster*, *texture*, *homogeneity*, *quality*, *cortex*, and *edge angle* were recorded for bifaces in the same manner as previously mentioned.

Completeness includes six different types to describes the state of the artifact. Complete is a perfectly or mostly intact artifact. Distal and proximal types describe an artifact where only the distal or proximal portions of the biface remains. Lateral refers to a biface segments exhibiting only a single lateral edge. A Medial biface section refers to a segment with both lateral edges bug neither a proximal nor distal end. Indeterminate pieces are biface segments where no discernible edge or end is present.

Stage – this attribute refers the stage of reduction sequence the biface or biface segment may have been in. The stages used in this project are based on Rasic’s sequence presented in his master’s thesis (2000: 69). The types include blank, edged blank, early stage bifacial blank, late stage bifacial blank, preform, and utilized or modified projectile point.

Haft Type includes seven types. Side notched, basal notched, corner notched, lanceolate, lateral, stemmed, and n/a.

Base Type includes flat, convex, concave, bipoint, or n/a.

Fracture type describes the character of a break in the biface. This attribute can be useful in determining in which stage of reduction an artifact might have been manufactures. A Bending fracture is defined as a break with a lipped profile moving away from the point of applied force; these are often seen as a straight break between lateral margins (Rasic 2000). Bending fractures account for most of the biface fracture types found in this assemblage. Perverse fractures are outlined by Crabtree (1972). They are found when an artifact is broken because the impact force twists perpendicular to the biface surface when moving from one margin to another. A reverse hinge fracture occurs when the impact force rolls into the objective piece, breaking it, rather than away, when a flake is created. Raw material flaws account for the only other type of fracture found in this assemblage other than bending. These kinds of breaks are due to the natural fracture patterns of the material or inconsistencies in the material such as quartz inclusions. Thermal fractures can also occur, these breaks lack points of applied force and may have evidence of thermal alteration such as pot lidding or crazing. Impact fractures can be used to determine if the tool was used as a projectile. Three types are included: Longitudinal, lateral and spin-off, although none were found in this assemblage.

Because there were so few bifaces in this assemblage and all demonstrated considerable variation from one-another, a short text description was included to describe other attributes such as type, size, and location of modification, if any.

<u>Uniface Attributes</u>

The attributes *completeness, platform, termination, thermal categories 1 and 2, dorsal scar count, raw material, color, luster, texture, homogeneity, quality, cortex, eraillure scar, lipping, bulb of force, width, length, thickness, weight, Position, Modification Type, Modification Intensity, modification type 2, modification type 3, edge shape, face position, modification length, sum of modification length,* and *edge angle* were recorded for unifaces in the same manner as mentioned in the debris or modified flake attributes.

The *type* attribute includes two categories: Short-axis beveled and long-axis beveled following Morlan (1976), Potter (2005), and Mobely (1991). Short axis beveled unifaces are typically refered to as end scrapers, in literature and describe the primary margin utilized as being on the proximal or distal edges. Long-axis beveled flakes are commonly referred to as side scrapers and describe the utilized edge as being on a lateral margin. The advantage of short-axis of long-axis beveled types is that, unlike side or endscraper, they do not imply a function.

Blank type consists of two categories: flake or blade. Blank type described the original shape of the uniface before manufacture and use.

The *Cross Section* attribute includes biconvex or planoconvex as categories. These describe the general shape of the uniface in profile.

Edge thickness is a measurement that measures the maximum dimension for the utilized edge of a uniface.

Edge Diameter is the straight-line measurement of an utilized edge as opposed to the edge length were convex and concave dimensions are taken into account

Microblade Attributes

The attributes *completeness, platform, termination, thermal categories 1 and 2, raw material, color, luster, texture, homogeneity, quality, cortex, edge damage, eraillure scar, lipping, bulb of force, length, weight, number of utilized margins, number of flake margins, percent utilized margins, position, modification type, modification intensity, modification type 2, modification type 3, face position, modification length, sum of modification length,* and *edge angle* were recorded for microblades in the same manner as mentioned in the debris or modified flake attributes.

Proximal width and *thickness* are measured in the same spot following Cook (1969:87). Both measurements were taken from the proximal end of the artifact or in cases were the proximal end is absent, from the widest end. This is in order to reduce error from the bulb of force.

Number of arrises is recorded instead of dorsal scar count to give a better description of the cross-section shape of the microblade. The differences can be seen in

Burin Attributes

The attributes *raw material, color, luster, texture, homogeneity, quality, cortex, thermal categories 1 and 2, modification type, position, width, length, thickness, weight* and *edge angle* were recorded for burins in the same manner as mentioned in the debris or modified flake attributes.

The attribute *type* encompasses a wide variability of forms. Following a number of researchers (Cook 1969; Powers 1983:114-119) the following types were included: transverse, dihedral, donnelly, notched, spalled, projectile point, burinated flakes, burin, burin on snap, angle, and core-burin. Transverse and burin on spa types are the only two types found in the Mead site assemblage therefore they will be the only types discussed. As defined by Powers (1983) transverse burin types are based on the lateral position of the burin facet and often edge damage will be indicated transversely along the distal end. The burin on snap type is indicated by burin damage located on the snapped edge of an artifact (Powers 1983).

Number of burin scars was also recorded along with the *location of burin scars*. Location includes right lateral, left lateral, proximal, distal. Additionally, the *direction of removal* was also recorded to indicate where the piece was struck to remove the spall.

<u>Burin Spall Attributes</u>

The attributes *raw material, color, luster, texture, homogeneity, quality, cortex, platform, termination, edge damage, thermal categories 1 and 2, modification type, position, modification intensity, modification type 2, modification type 3, edge shape, face position, modification length, sum of modification length, edge angle, width, length, thickness,* and *weight* were recorded for burin spalls in the same manner as mentioned in the debris or modified flake attributes.

For burin spalls, *depth of damage* was also recorded; this measures the invasiveness of any modification on the face of the burin spall.

<u>Flake Core Attributes</u>

The attributes *raw material, color, luster, texture, homogeneity, quality,* and *cortex* were recorded for flake cores in the same manner as mentioned in the debris or modified flake attributes.

Number of flake scars records the quantity of flake scars on a single core

Scar max width measures the maximum dimension for width for any flake scar on a core.

Scar max length measures the maximum dimension for length for any flake scar on a core.

Maximum linear dimension measures the largest measurement for the flake scar disregarding orientation of the piece.

Width, thickness, and *length* were all measured as maximum dimensions on a flake core.

Weight was measured in kilograms on an AE Adam CWP Plus-75 scale.

Size value was calculated by multiplying weight with the maximum linear dimension measurement in order to rank cores against each other by size.

Appendix C Raw Material Summary

Table C-1 Raw material summaries by subarea

CZ	1b							2		3b			4				
Subarea	A1	B1	B2	B3	B4	C1	C2	D1	E1	F1	G1	H1	I1	K1	J1	J2	J3
andesite	0	0	0	0	0	0	0	0	0	0	0	37	0	0	18	0	8
banded chalcedony	0	0	0	0	1	1	1	8	2	29	0	10	3	3	0	0	0
black basalt	0	0	1	0	6	0	1	0	0	0	0	0	0	0	0	0	0
black chert	1	0	1	0	2	42	0	6	1	2	1	0	0	1	0	0	0
brown chert	3	1	0	3	6	1	0	1	2	0	0	0	0	0	1	0	0
brown quartzite	11	99	0	0	6	337	1	27	17	1	3	6	0	0	0	0	0
grey quartzite	0	8	1	1	1	223	0	6	2	2	2	7	0	0	0	0	0
grey basalt	3	0	0	0	2	0	0	0	0	2	1	19	0	0	7	0	0
grey chalcedony	0	0	0	0	4	1	0	3	2	9	2	18	0	9	24	2	0
grey chert	1258	10	24	199	577	151	20	1014	838	74	7	68	14	16	3	1	1
jasper	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
obsidian	0	0	0	0	1	0	0	1	0	0	0	0	0	0	5	1	0
red/grey siltstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
rhyolite	203	0	0	0	346	4	0	5	0	0	0	0	0	0	0	0	0
quartz	0	0	0	0	1	0	0	2	0	3	84	2	1	10	136	601	4
total	1479	118	27	203	954	760	23	1074	864	122	100	167	18	39	202	605	13
clusters >n=3	3	3	1	1	6	5	1	6	2	3	2	7	1	3	6	1	2
clusters >n=30	2	1	0	1	2	4	0	1	1	0	1	2	0	0	1	1	0

Appendix D Raw Material Descriptions

Table D-1 Raw Material Variations

Raw Material	Color variation	Luster variation	Texture variation	Homo-geneity	Quality Variation	Notes
andesite	5Y 4/1, Gley 1 4/N, Gley 1 5N	dull	medium	1-2	fair	
banded chalcedony	Gley 1 7/10Y, Gley 1 7/N, Gley 1 6/10Y, Gley 1 6/N, 5Y 7/1, Gley 1 2/N, Gley 1 2/N, Gley 1 4/N, Gley 1 5/N, 2.5Y 7/1, 2.5Y 7/2, 10YR 5/3, 10YR 6/1, 10YR 6/2, 2.5Y 4/1, 2.5Y 6/1, 2.5Y 6/2	waxy, vitreous	fine	1	excellent	Black banding does not affect fracture mechanics. Color variations largely due to variable thickness of artifacts.
black basalt	10YR 2/1, 10YR 3/1, 10YR 3/2, Gley 1 2.5/N	dull	medium, fine	1	excellent	
black chert	2.5Y 2.5/1, Gley 1 1/N, Gley 1 2.5/N, Gley 1 2/N, Gley 1 3/N, Gley 2 2.5/10B	dull, vitreous, glassy	fine	1-2	excellent, fair	
brown chert	10YR 4/6, 10YR5/3, 10YR 6/3, 2.5Y 7/3, 2.5Y 8/2, 2.5Y 3/3, 2.5Y 5/3, 7.5YR 3/2, 7.5YR 4/3, 7.5YR 5/3	dull, vitreous	fine, medium	1-3	excellent, fair, poor	
grey quartzite	10YR 3/1, 10YR 4/1, 10YR 4/2, 10YR 5/1, 10YR 5/2, 2.5Y 4/1, 2.5Y 5/2, 2.5YR 4/1, 5Y 4/1, 7.5YR 4/1, 7.5YR 5/1, Gley 1 1/N, Gley 1 3/N, Gley 1 4/N	dull	fine, medium	1-2	fair, poor	
grey basalt	10YR 4/1, 2.5Y 4/1, 5Y 3/1, 5Y 4/1, 5Y 5/1, 5Y 6/1, Gley 1 3/N, Gley 1 4/N, Gley 1 5/N	dull, vitreous	fine, medium	1-2	excellent, fair	

Table D-1 continued

grey chalcedony	10YR 4/1, 10YR 5/2, 10YR 6/1, 10YR 7/1, 10YR 7/2, 2.5Y 4/2, 2.5Y 5/1, 2.5Y 6/1, 2.5Y 7/1, 2.5Y 7/2, 2.5Y 7/3, 2.5Y 8/1, 5Y 4/1, 5Y 5/1, 5Y 6/1, 5Y 7/1, 5Y 8/1, Gley 1 4/N, Gley 1 5/10Y, Gley 1 7/10Y, Gley 1 7/N, Gley 1 8/10Y, Gley 1 8/N	waxy, vitreous	fine	1-2	excellent, fair	Two different types of grey chalcedony: milky grey chalcedony and brownish grey chalcedony. Materials were lumped together for analysis purposes.
grey chert	10YR 3/1, 10YR 3/2, 10YR 4/1, 10YR 4/2, 10YR 5/1, 10YR 5/2, 10YR 6/1, 10YR 6/2, 10YR 7/2, 2.5Y 3/1, 2.5Y 4/1, 2.5Y 5/2, 2.5Y 6/1, 2.5Y 6/2, 2.5Y 7/1, 2.5Y 8/4, 2.5YR 3/1, 2.5YR 6/1, 5Y 3/1, 5Y 4/1, 5Y 4/1, 5Y 5/1, 5Y 5/2, 5Y 6/1, 5Y 6/2, 5Y 7/1, 5YR 4/3, Gley 1 3/10Y, Gley 1 3/N, Gley 1 4/10Y, Gley 1 4/N, Gley 1 5/10Y, Gley 1 5/N, Gley 1 6/10Y, Gley 1 6/5GY, Gley 1 6/N, Gley 1 7/10Y	vitreous, dull	fine, medium	1-2	excellent, fair	
jasper	2.5YR 2.5/2, 2.5YR 2.5/3, 2.5YR 3/3, 2.5YR 3/4, 2.5YR 4/2	vitreous	fine	1	excellent, fair	
obsidian	5Y 3/1, Gley 1 1/N, Gley 1 2/N, Gley 1 3/N, Gley 1 4/N, Gley 1 5/N, Gley 1 6/N, Gley 1 6/N, Gley 1 8/N	glassy	fine	1	excellent	
petrified wood	2.5Y 5/2	vitreous	fine	1	excellent	

Table D-1 continued

rhyolite	10YR 3/2, 10YR 4/1, 10YR 5/3, 10YR 5/4, 10YR 6/1, 10YR 6/2, 10YR 6/3, 10YR 6/4, 10YR 7/1, 10YR 7/2, 10YR 7/3, 10YR 7/4, 2.5Y 3/1, 2.5Y 5/2, 2.5Y 5/3, 2.5Y 6/2, 2.5Y 6/3, 2.5Y 7/4, 5Y 4/1, 5Y 5/2	vitreous, dull	fine	1-2	excellent, fair	This rhyolite is extremely brittle and many flakes were broken during recovery. Sourced to Type X rhyolite also found at Gerstle River using cortex similarities.
quartz	5Y 8/1, 10YR 5/1, 10YR 6/3, 10YR 7/1, 10YR 7/2, 10YR 7/3, 10YR 7/4, 10YR 8/1, 2.5Y 4/1, 2.5Y 4/2, 2.5Y 7/1, 2.5Y 7/2, 2.5Y 7/3, 2.5Y 8/1, 2.5Y 8/2, 5Y 5/1, 5Y 7/1, 5Y 8/1, 5YR 4/4, Gley 1 3/N, Gley 1 4/N, Gley 1 4/N, Gley 1 5/N, Gley 1 7/10Y	glassy, vitreous	fine, medium	1-2	poor, fair	
red/grey siltstone	5YR 4/2	dull	fine	1	fair	
brown quartzite	10YR 3/2, 10YR 4/2, 10YR 4/3, 10YR 5/2, 10YR 5/3, 10YR 5/4, 10YR 6/1, 10YR 6/2, 10YR 6/3, 10YR 6/4, 10YR 7/2, 10YR 7/3, 10YR 7/4, 10YR 8/3, 2.5Y 5/2, 2.5Y 5/3, 2.5Y 7/3, 2.5Y 7/4, 2.5Y 8/2, 2.5YR 4/4, 2.5YR 5/3, 5YR 4/2, 5YR 5/3, 7.5YR 4/2, 7.5YR 4/3, 7.5YR 4/4, 7.5YR 5/2, 7.5YR 5/3, 7.5YR 5/4, 7.5YR 6/3, 7.5YR 6/4	dull	medium	1-2	poor, fair	

Appendix E Block Backplots

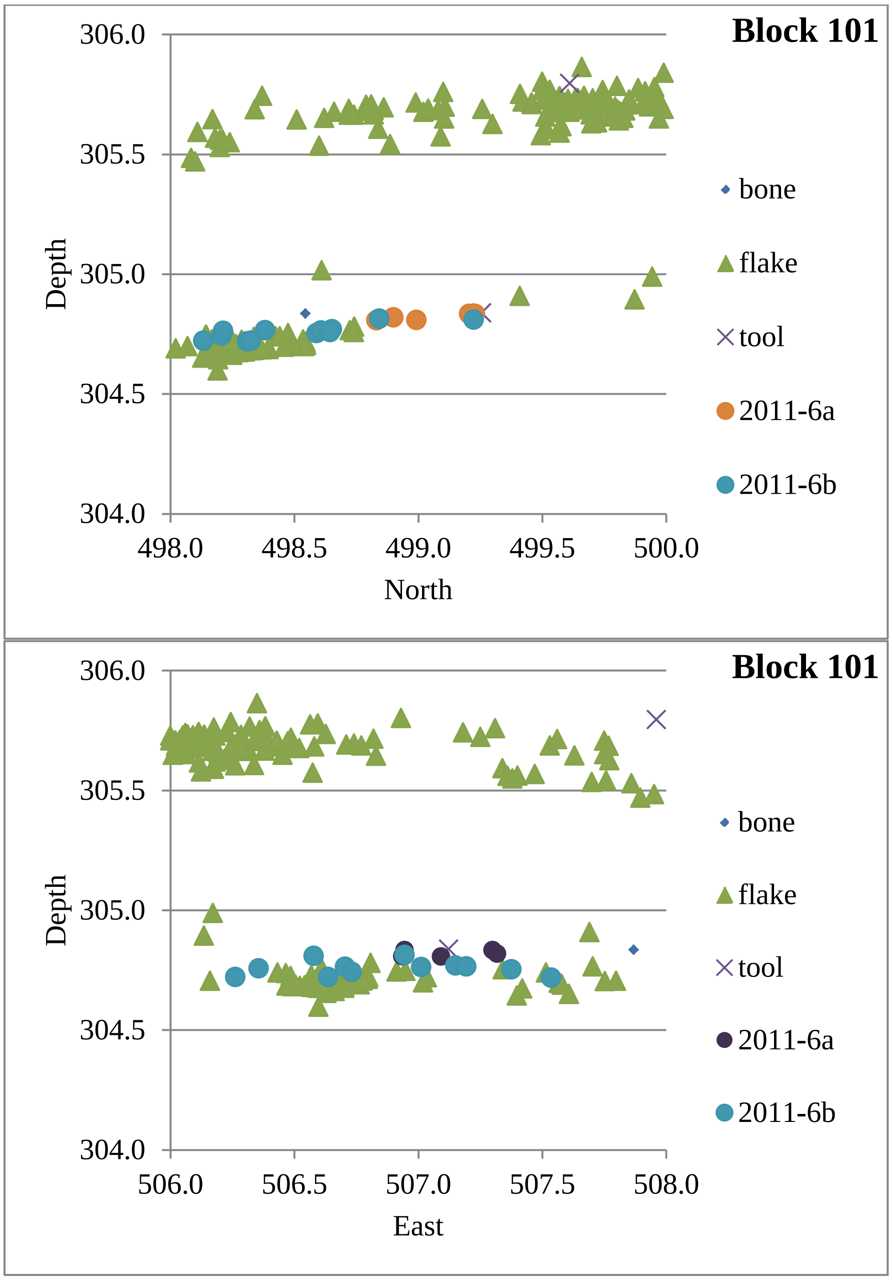


Figure E-1 Block 101 backplots

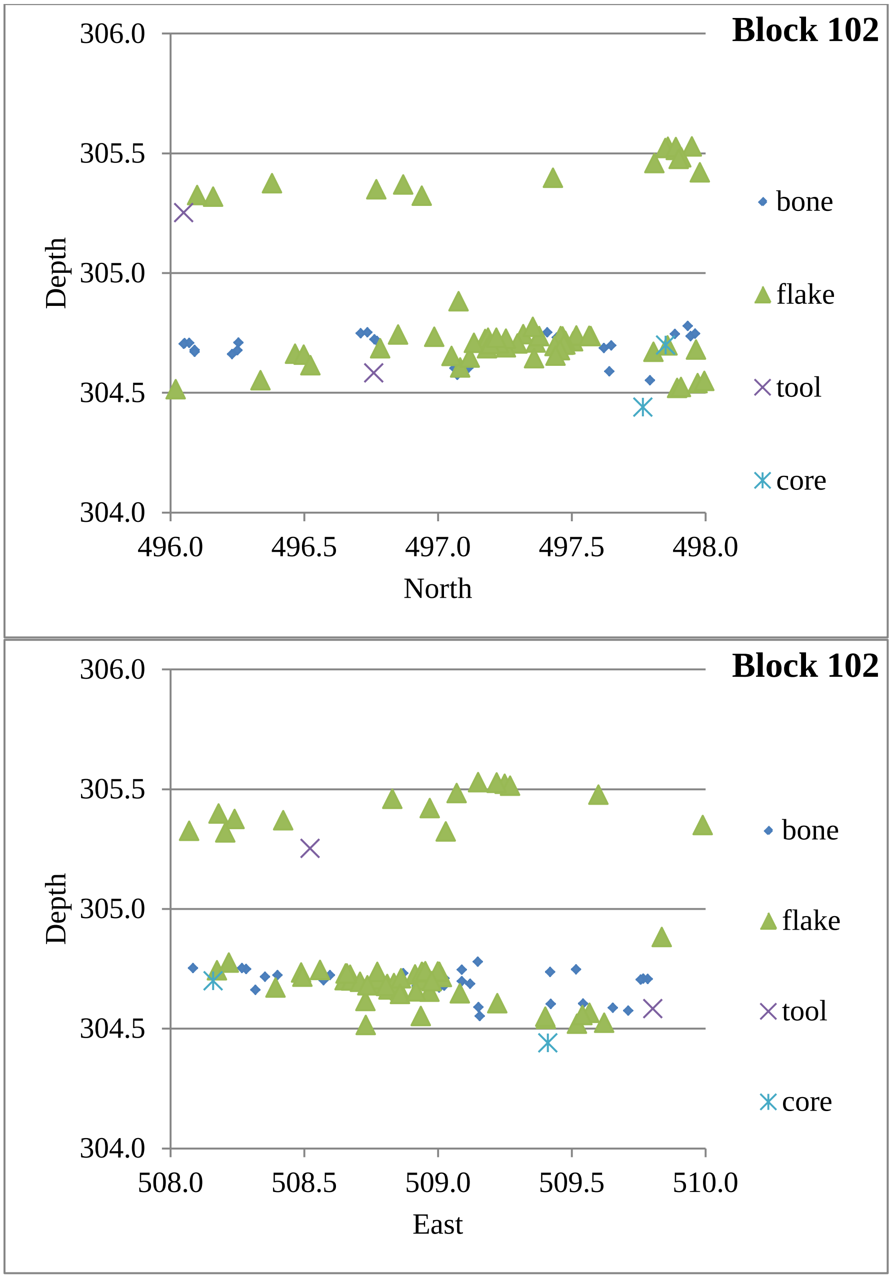


Figure E-2 Block 102 backplots

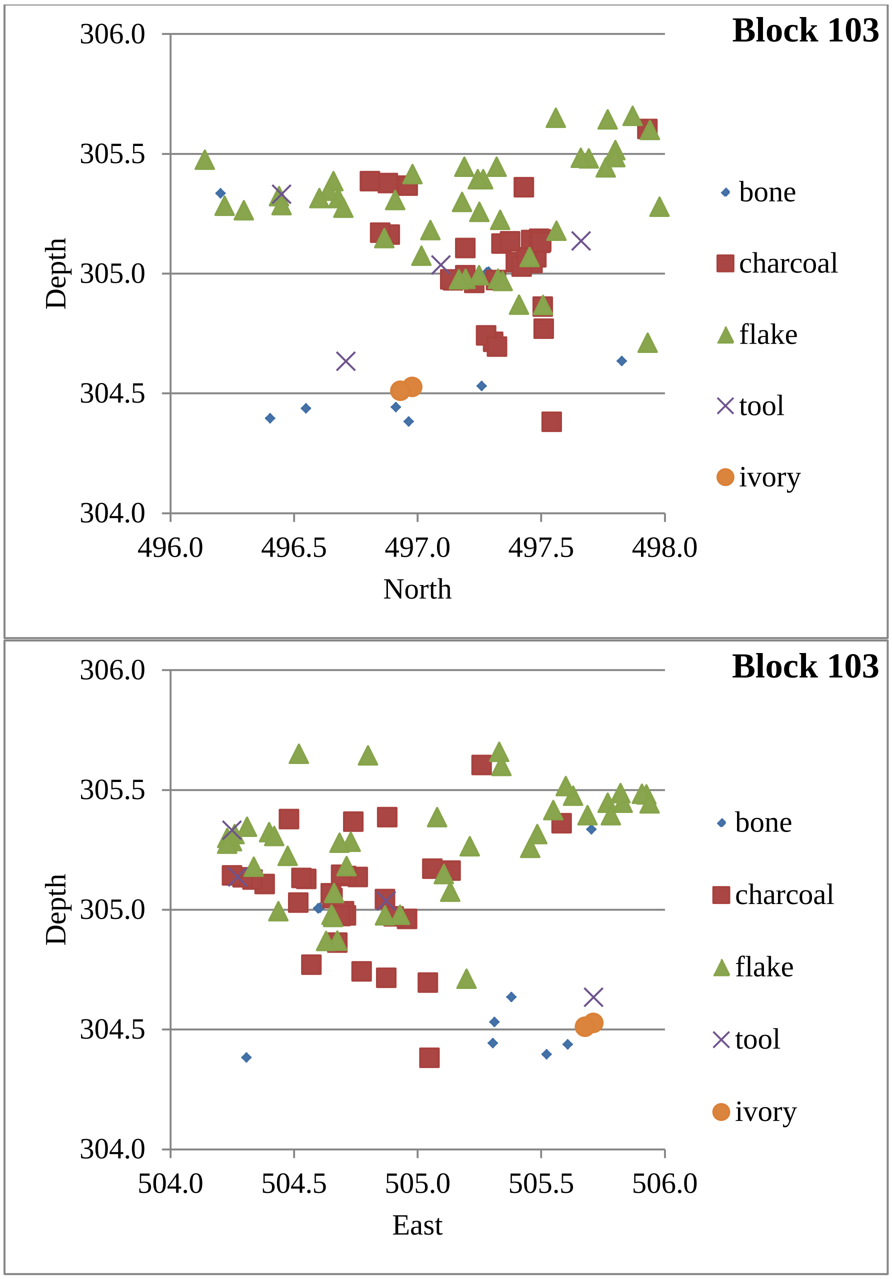


Figure E-3 Block 103 backplots

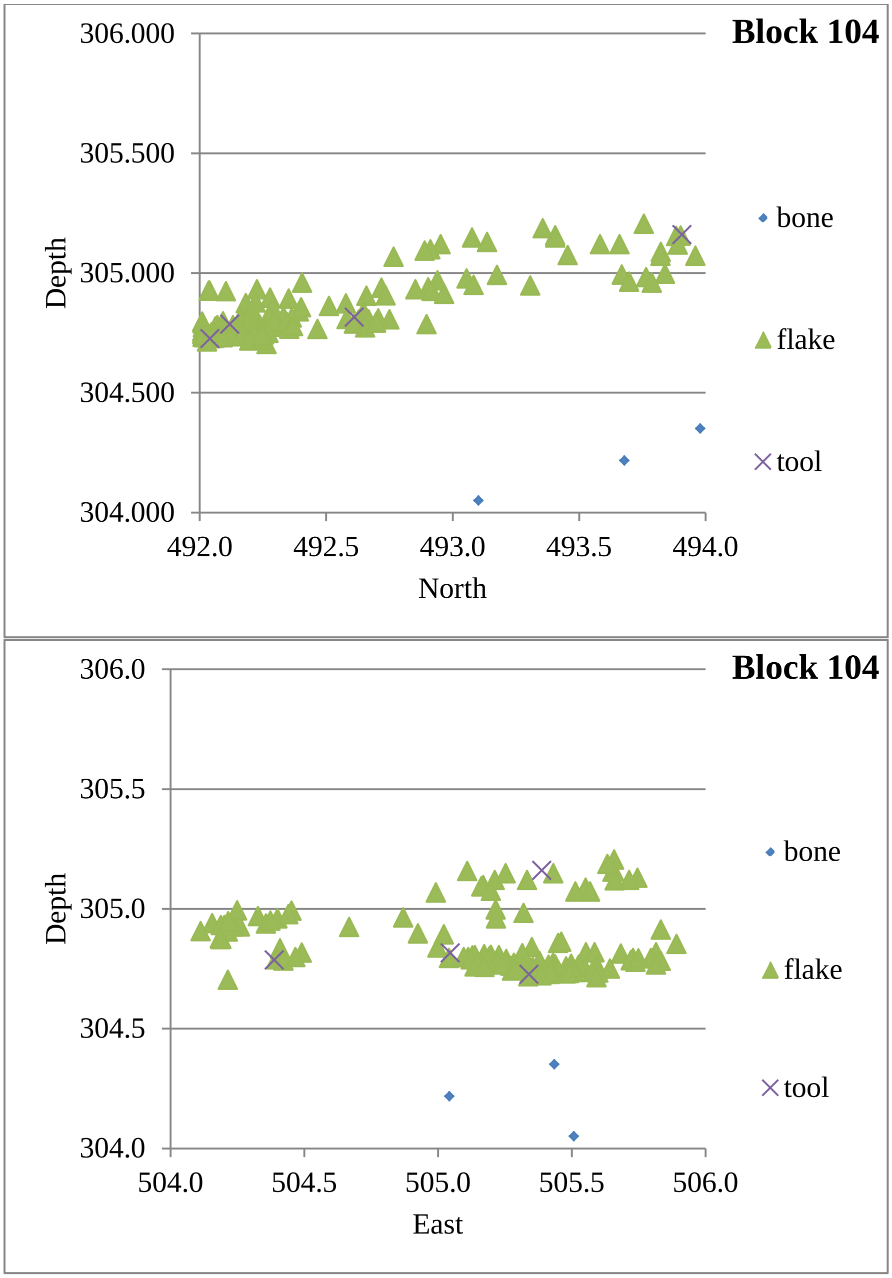
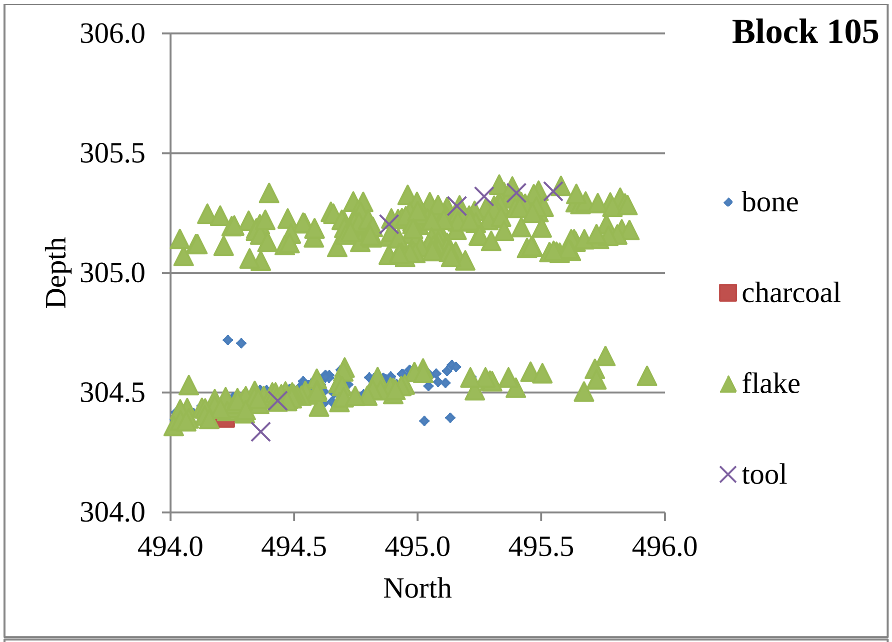


Figure E-4 Block 104 backplots



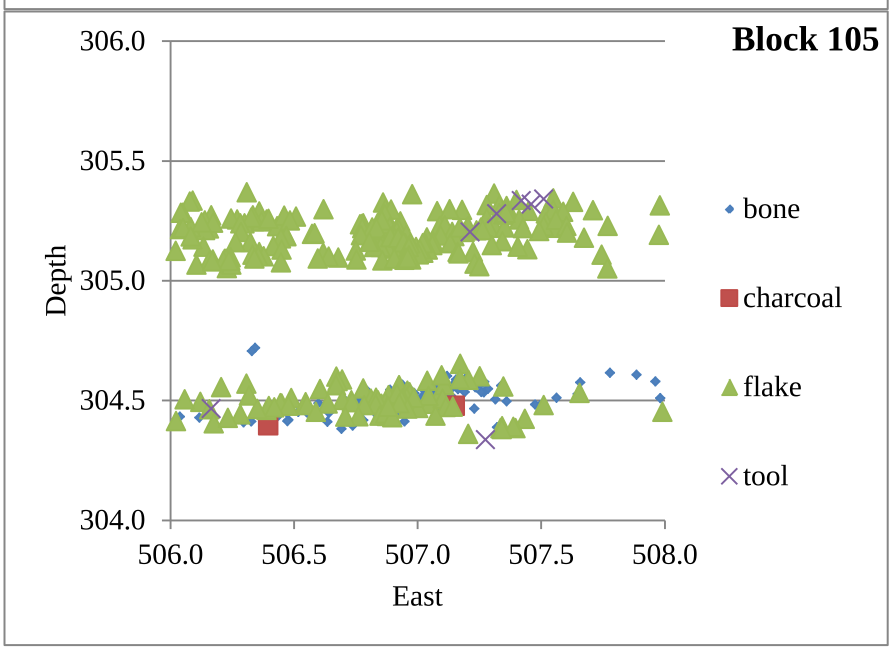
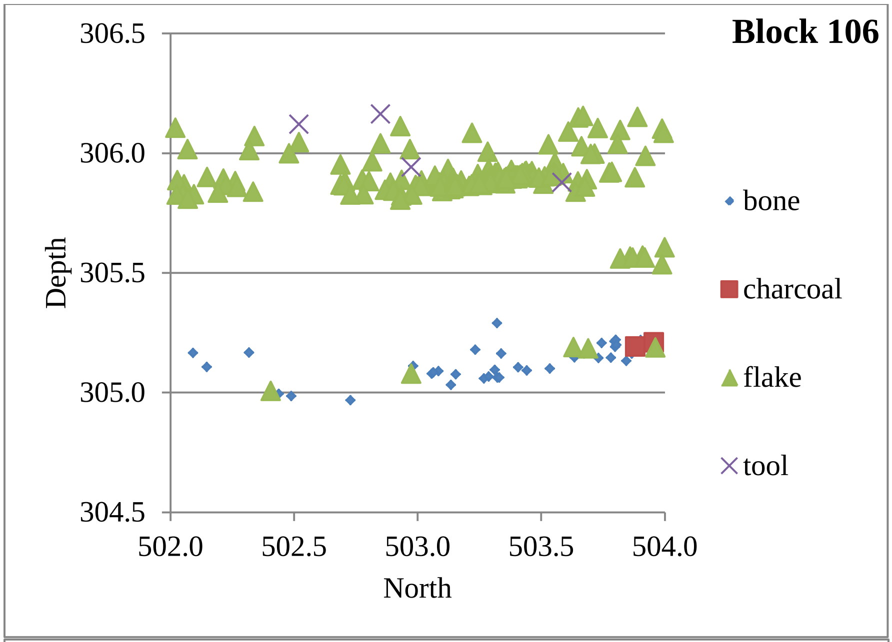


Figure E-5 Block 105 backplots



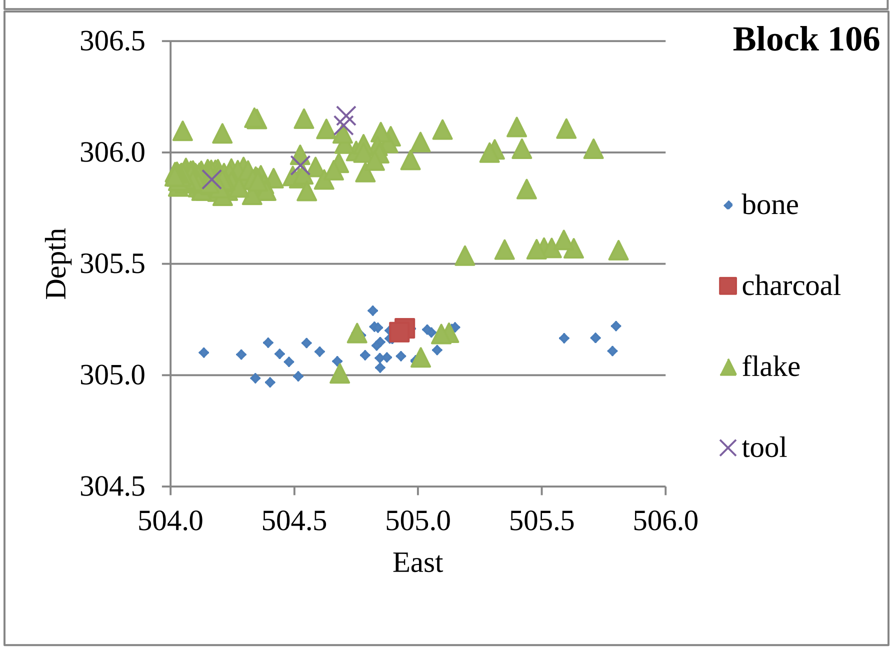
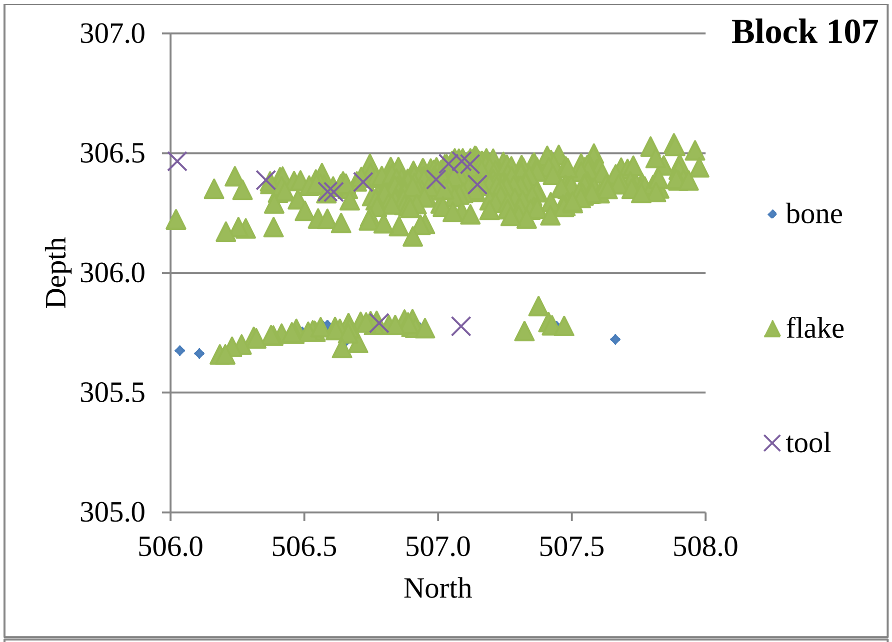


Figure E-6 Block 106 backplots



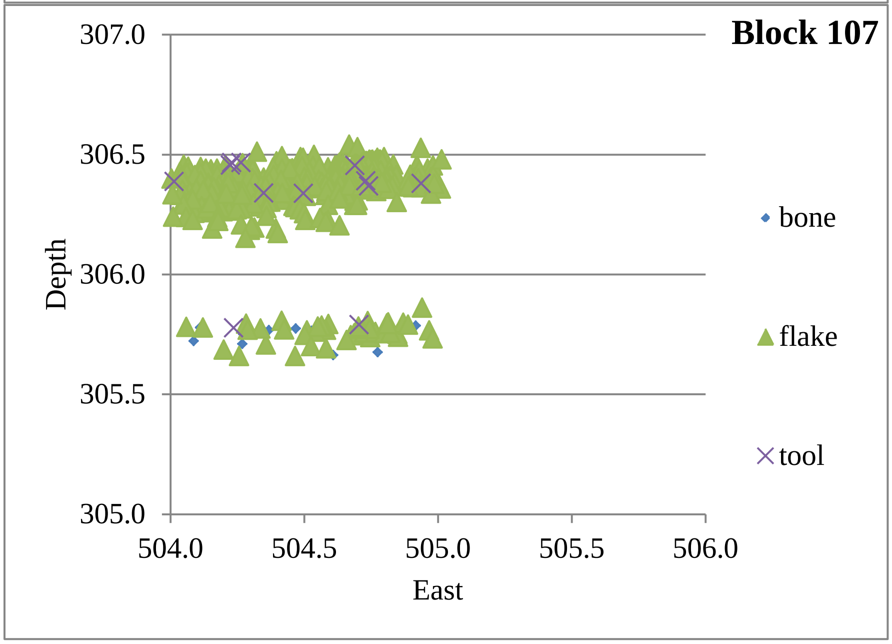


Figure E-7 Block 107 backplots

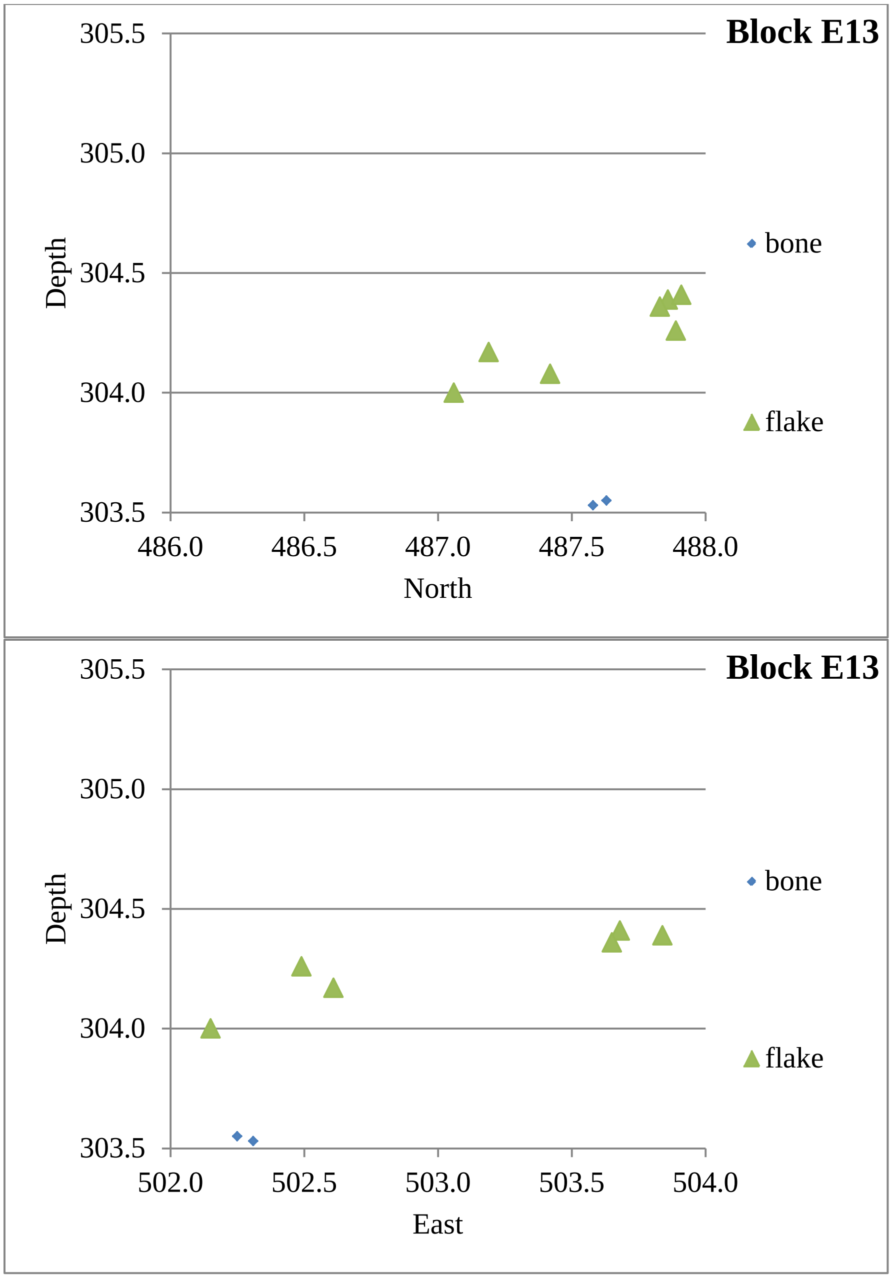


Figure E-8 Block E13 backplots

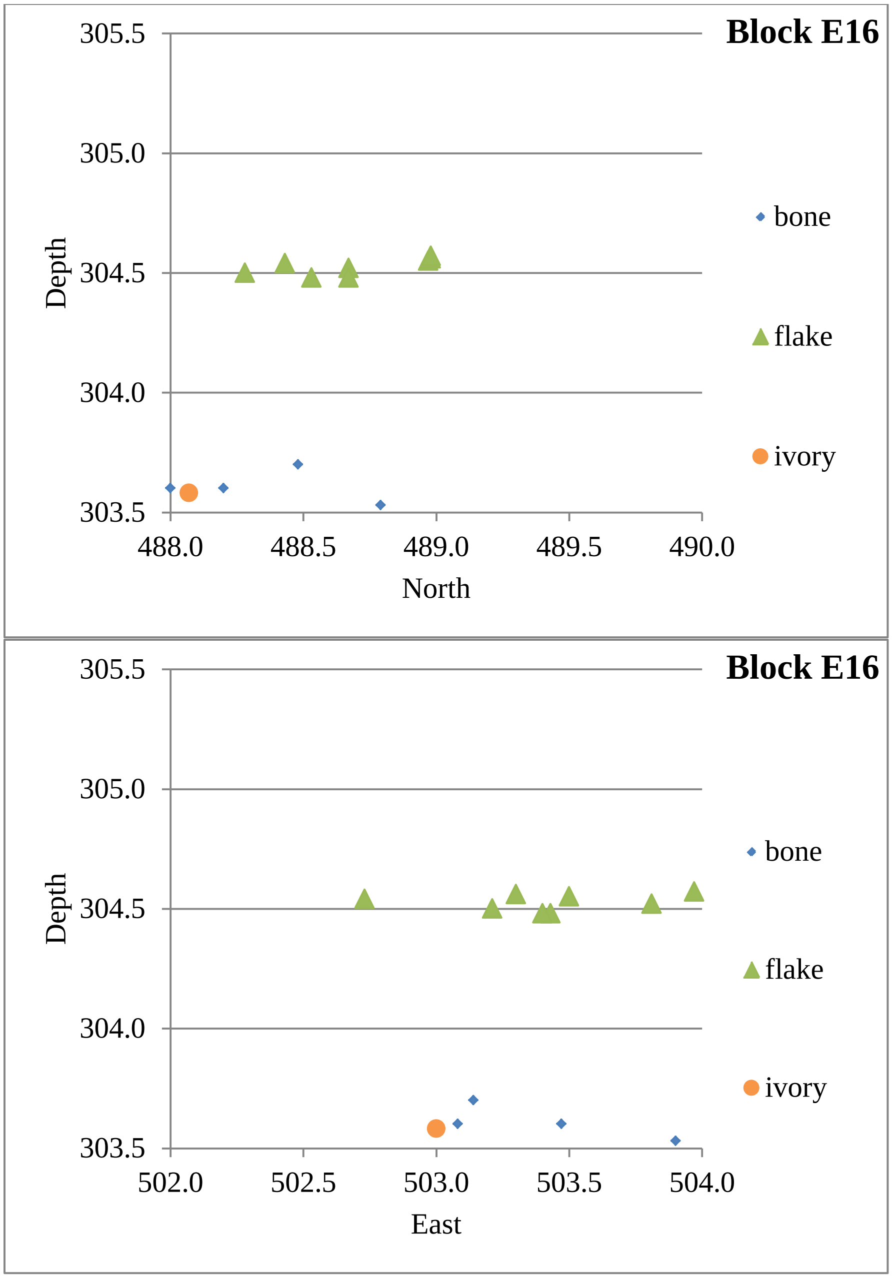
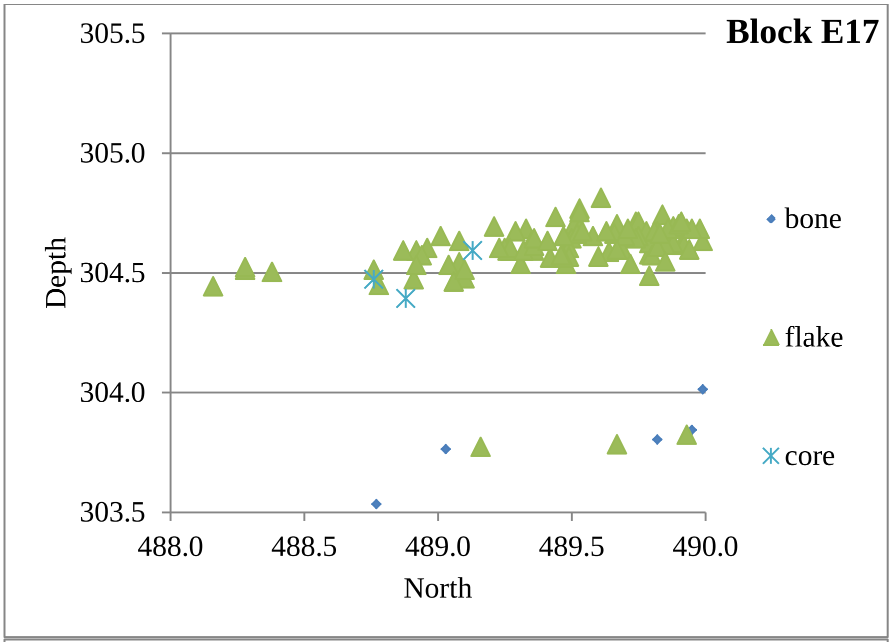


Figure E-9 Block E16 backplots



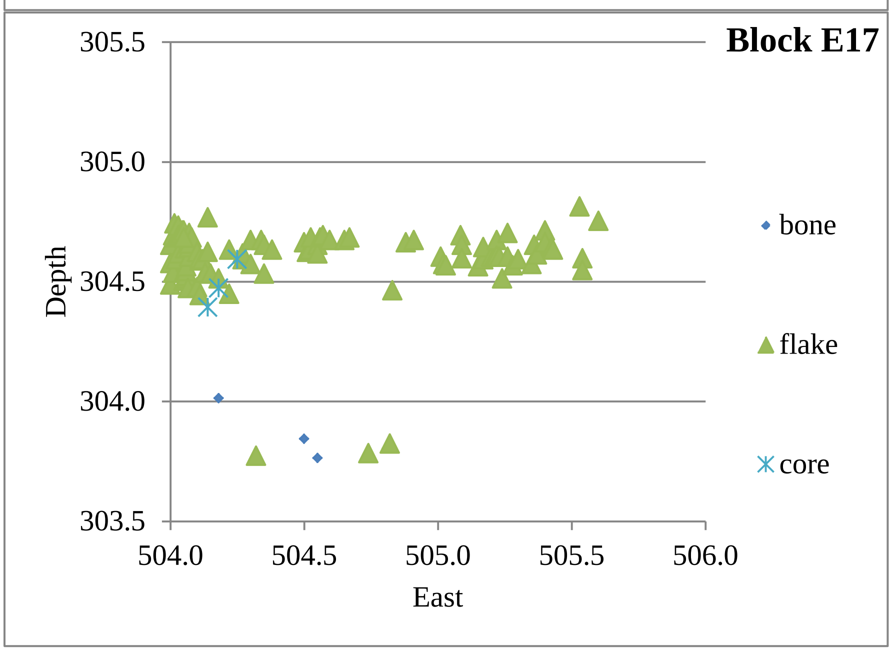


Figure E-10 Block E17 backplots

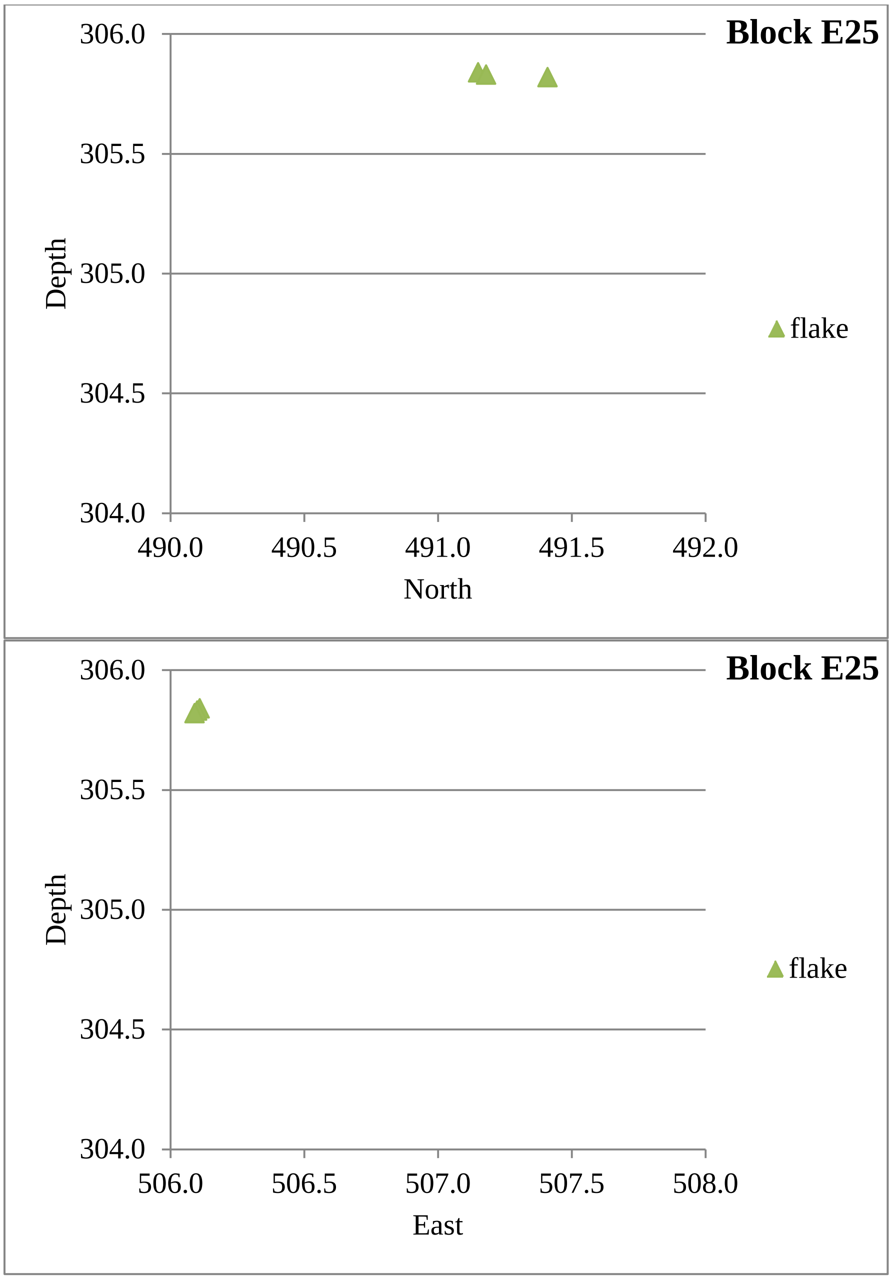
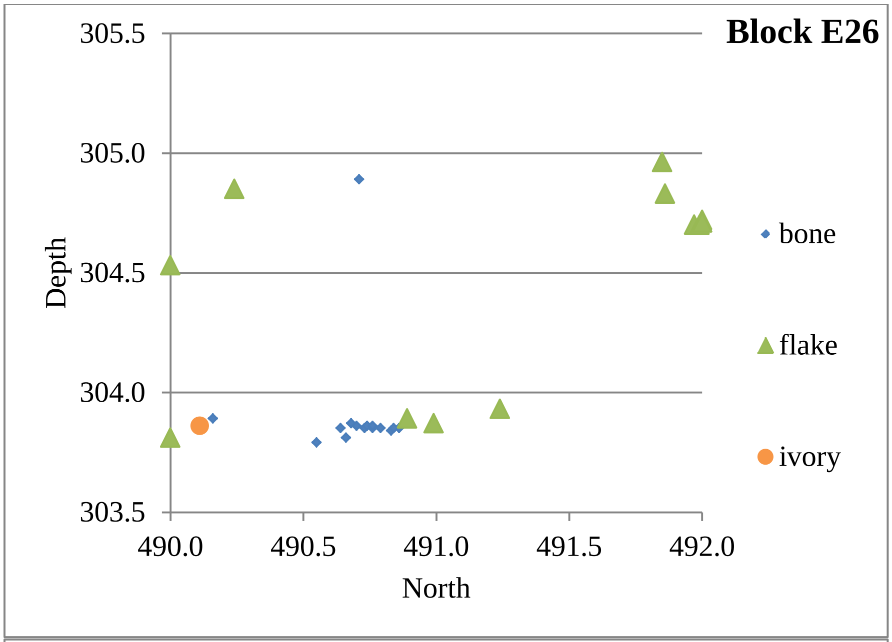


Figure E-11 Block E25 backplots



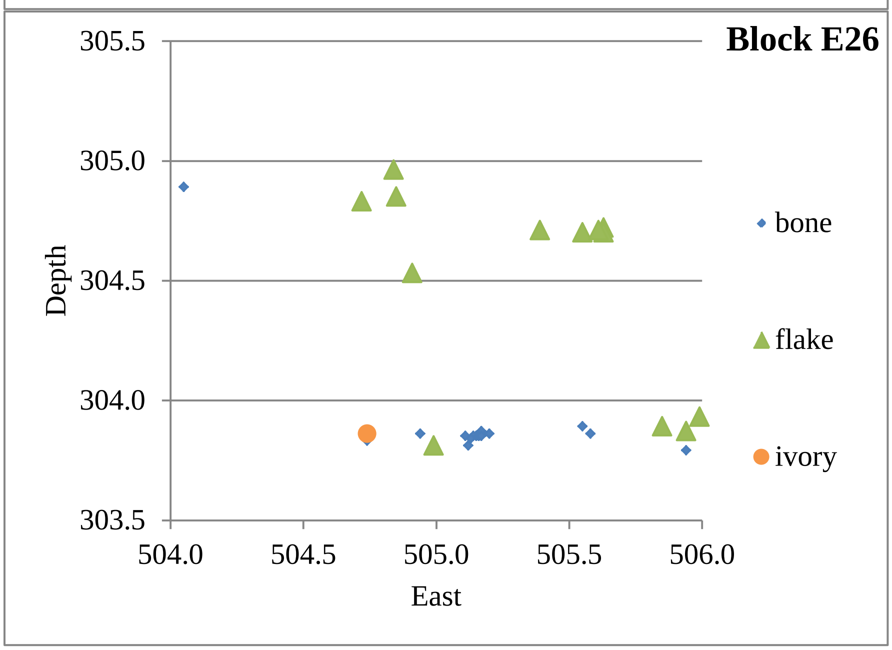


Figure E-12 Block E26 backplots

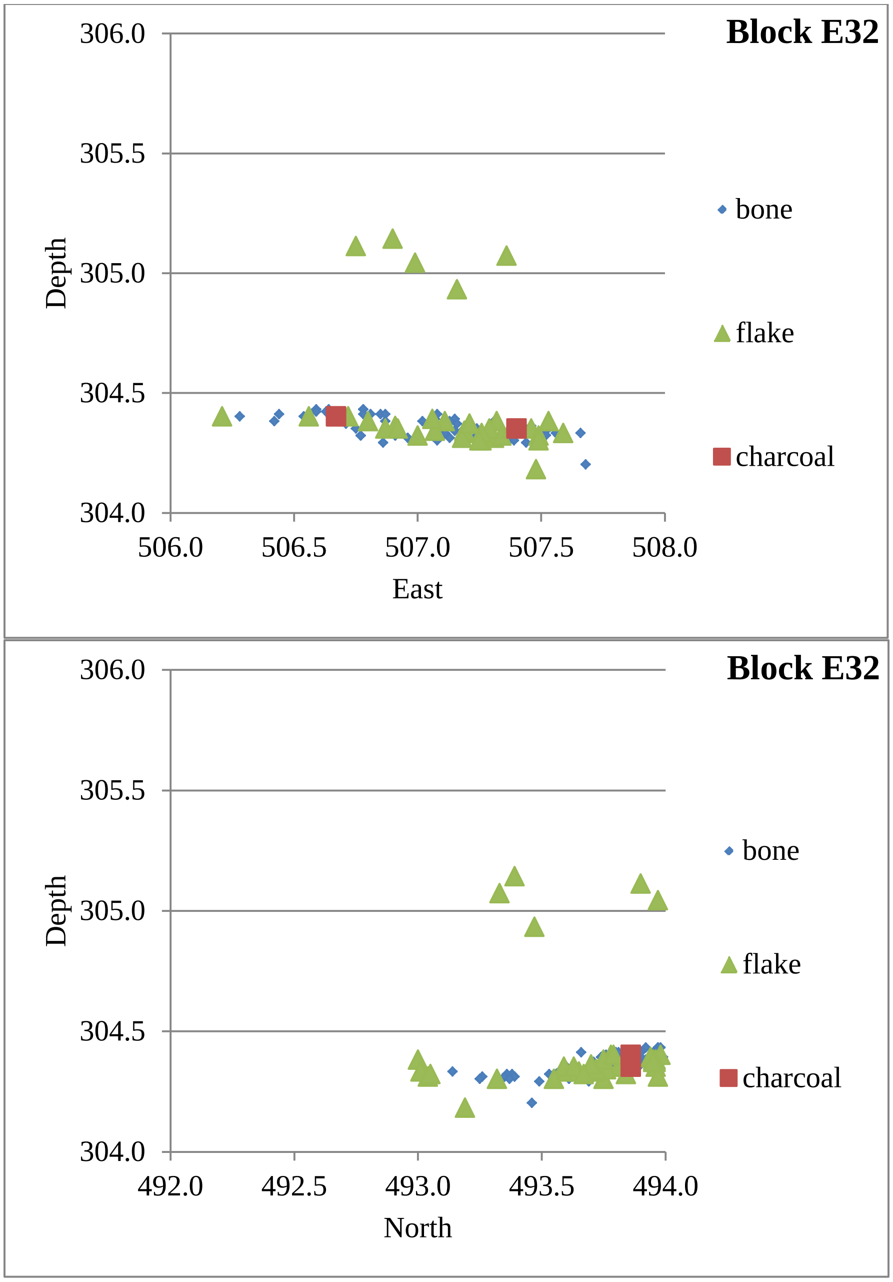
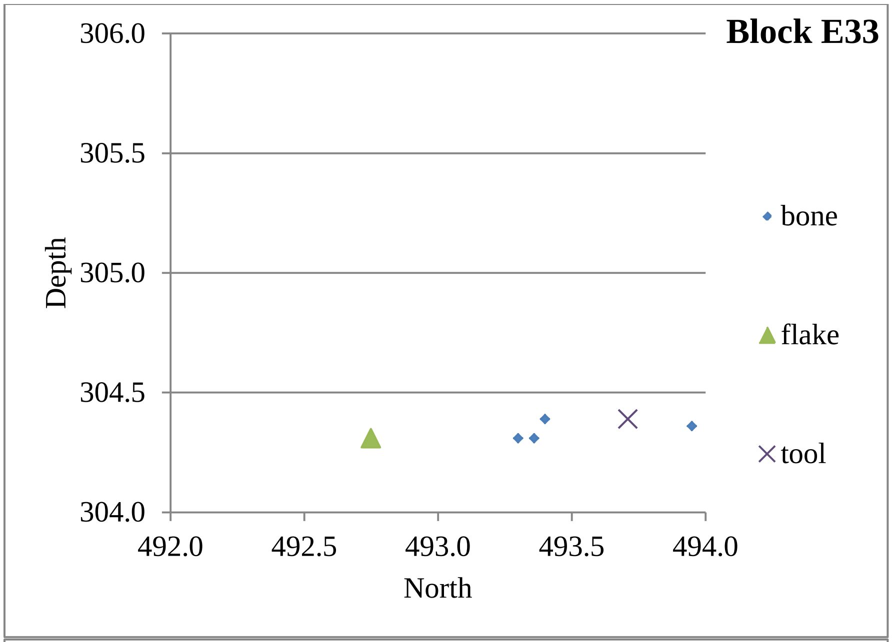


Figure E-13 Block E32 backplots



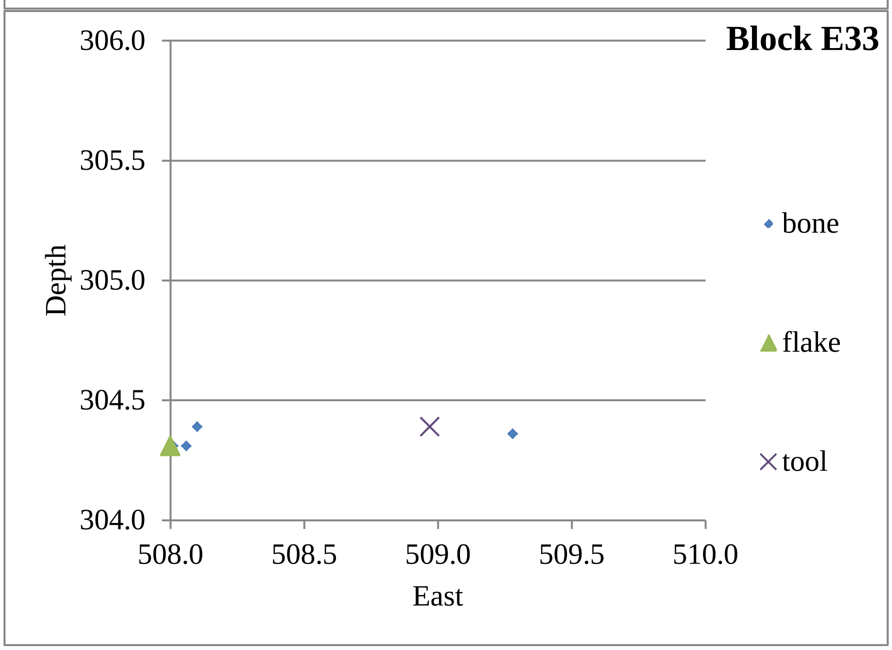
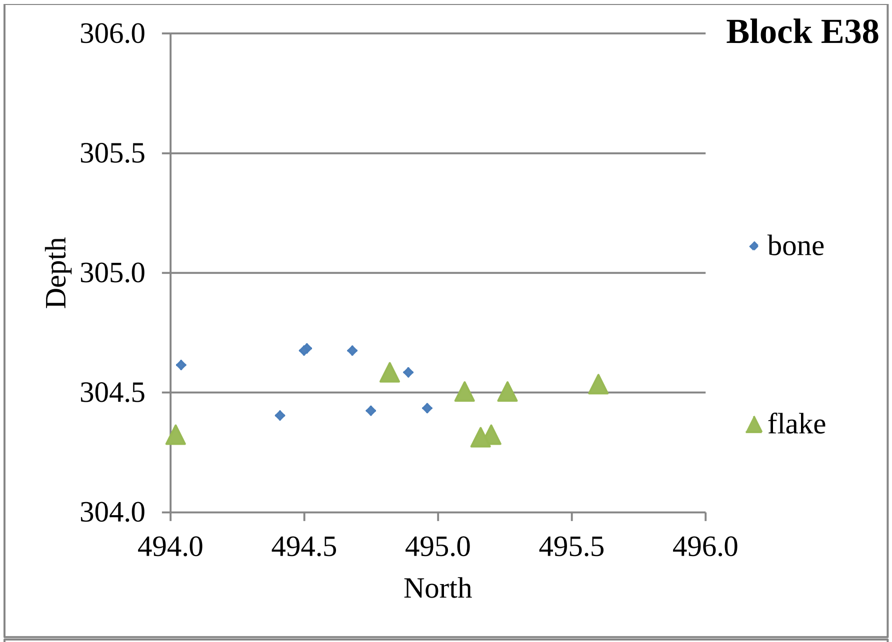


Figure E-14 Block E33 backplots



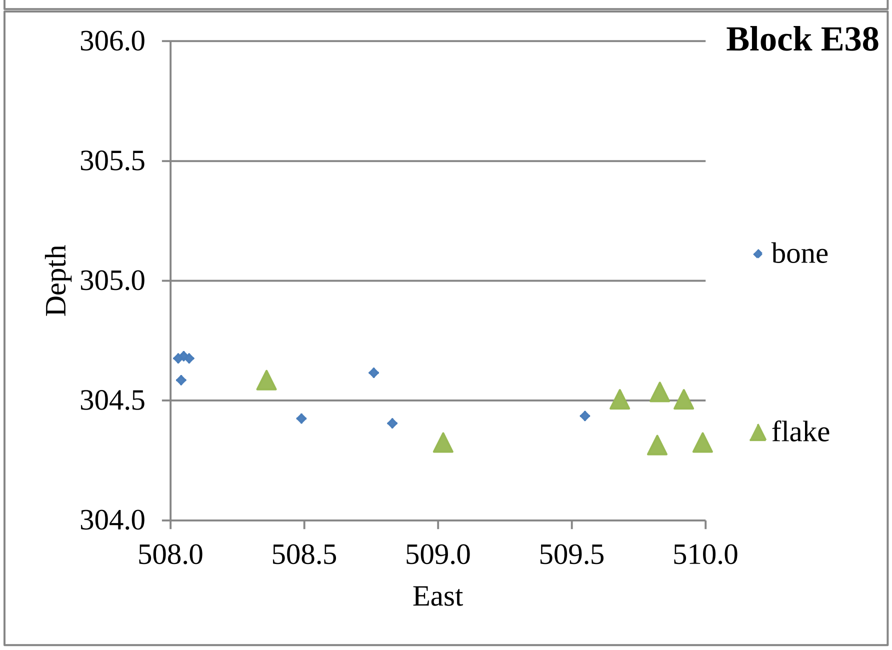
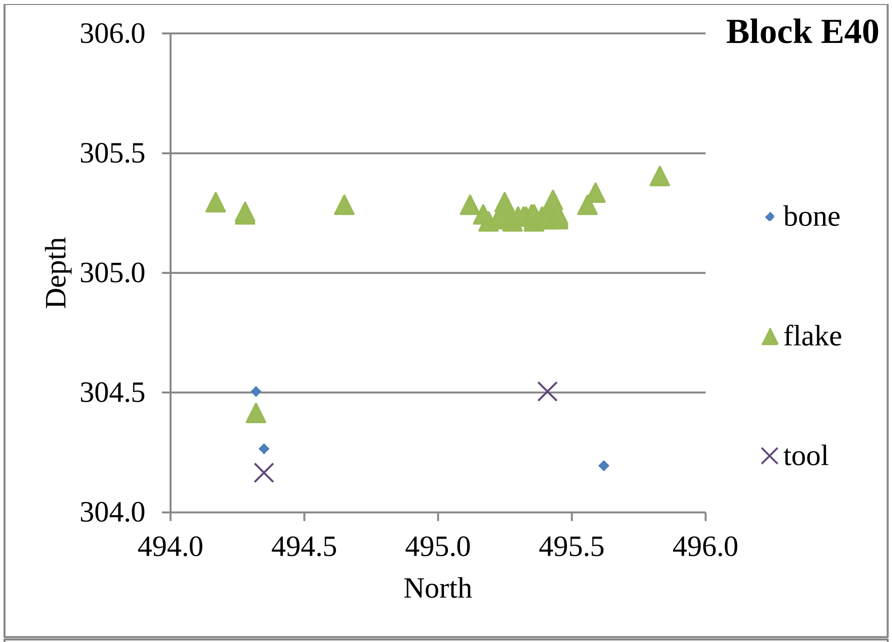


Figure E-15 Block E38 backplots



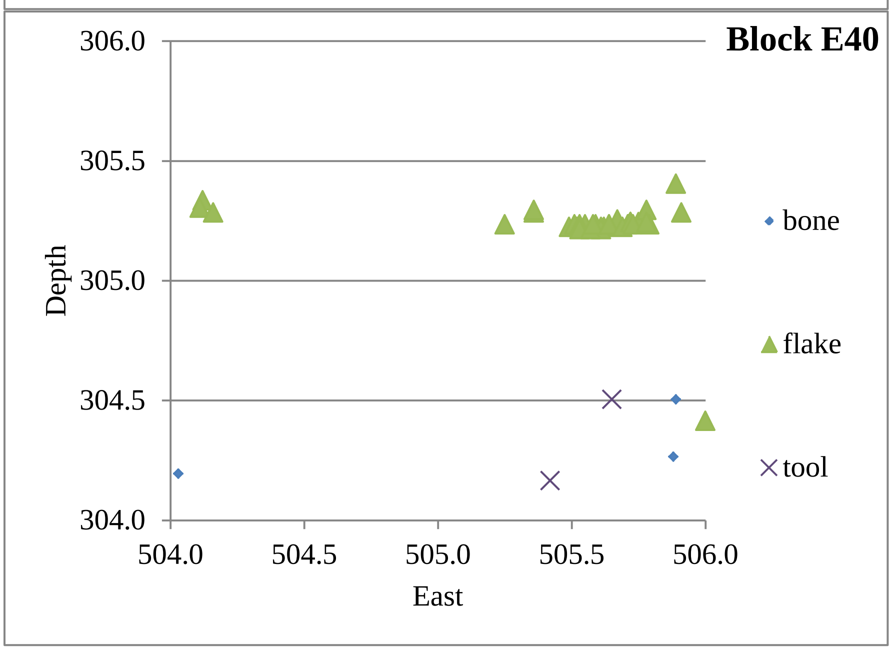
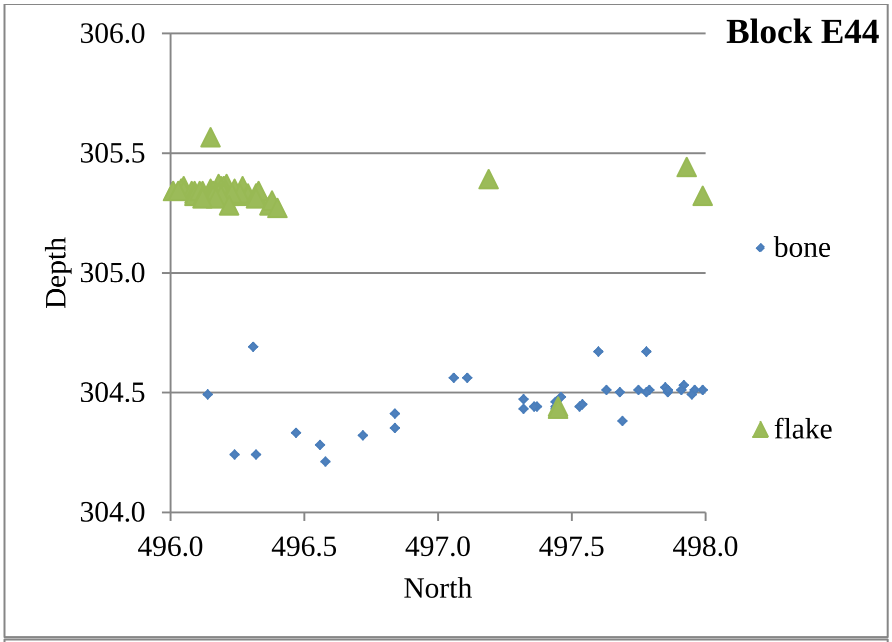


Figure E-16 Block E40 backplots



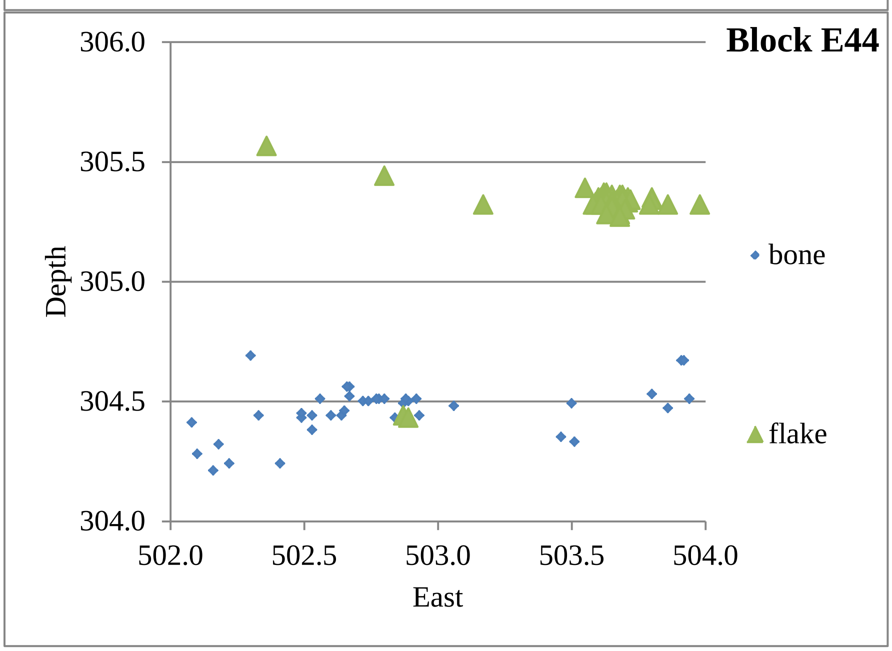


Figure E-17 Block E44 backplots

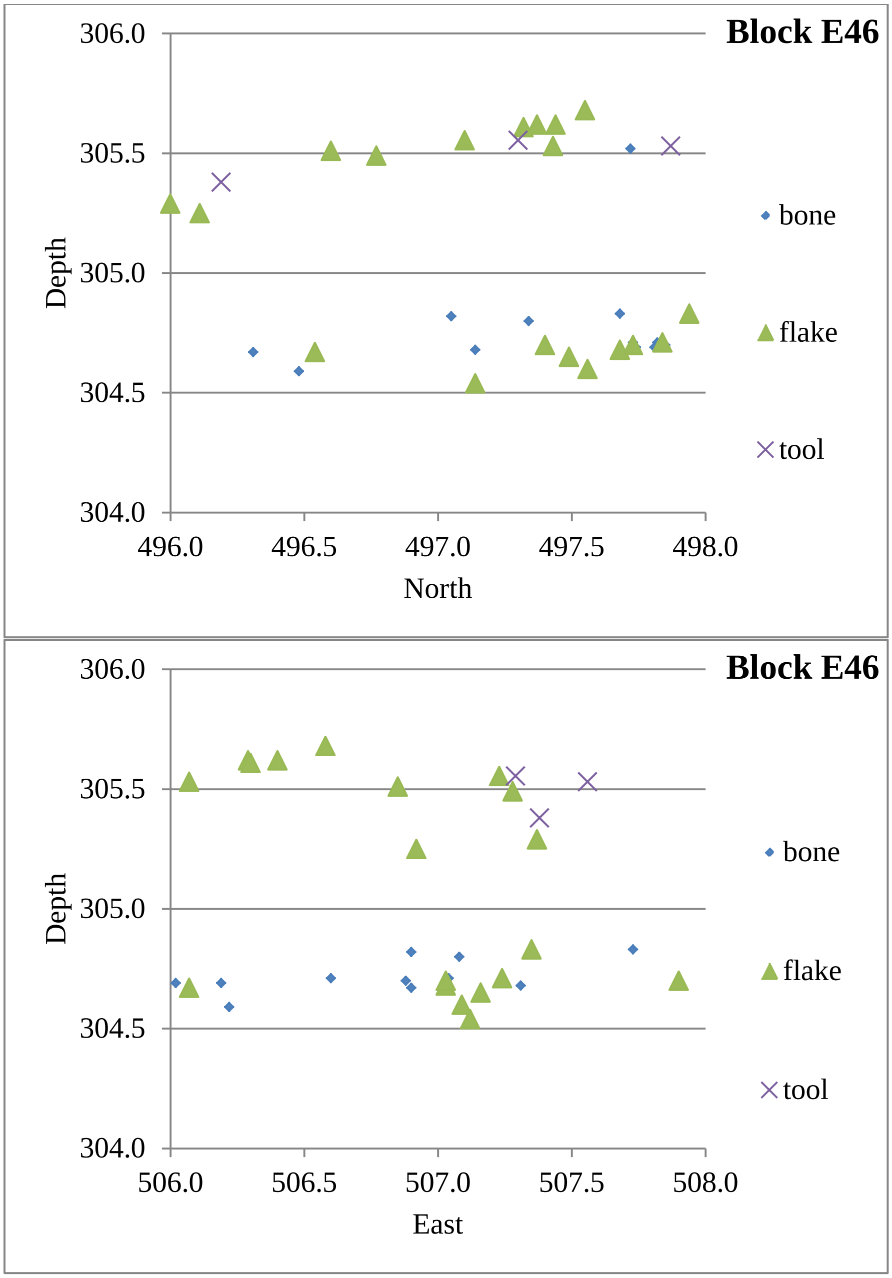
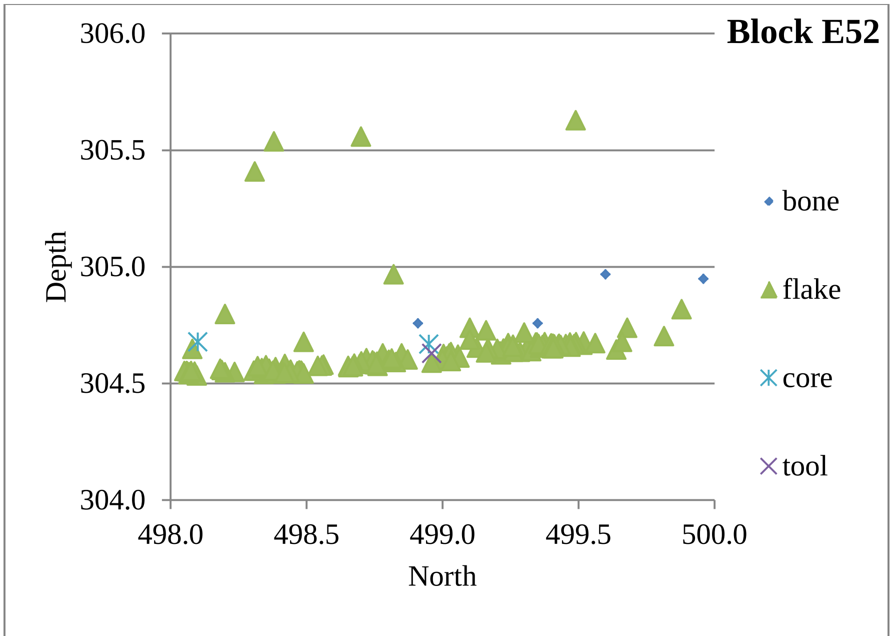


Figure E-18 Block E46 backplots



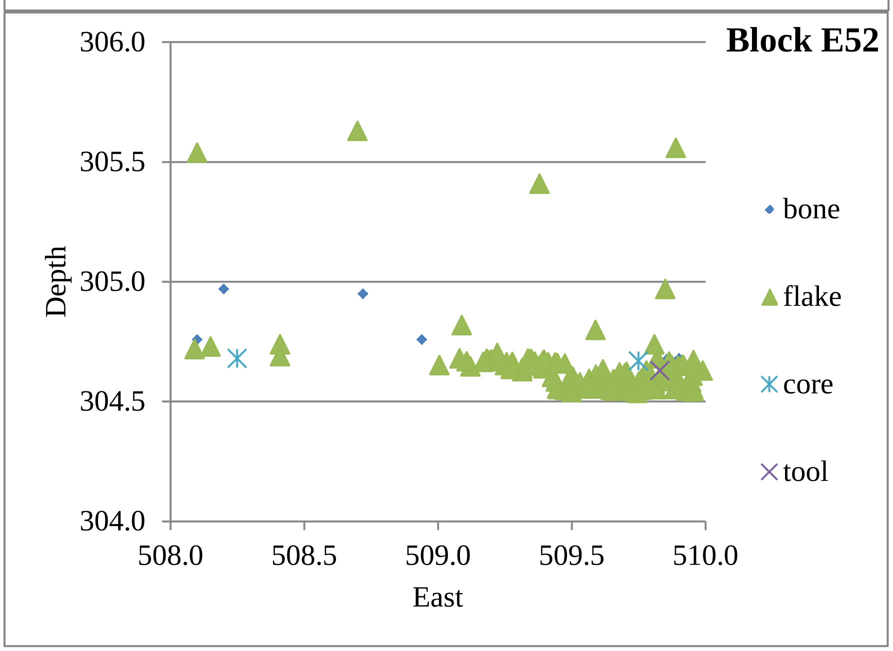


Figure E-19 Block E52 backplots